Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES DEPARTMENT OF AGRICULTURE
BULLETIN No. 1027
Contribution from the Bureau of Chemistry
W. G. CAMPBELL, Acting Chief

Washington, D. C. ▼ April 17, 1922

POISONOUS METALS ON SPRAYED FRUITS AND VEGETABLES

BY

W. D. LYNCH, Assistant Chemist, C. C. McDONNELL, Chief, Insecticide and Fungicide Laboratory, and J. K. HAYWOOD, Chief, Miscellaneous Division, Bureau of Chemistry; A. L. QUAINTANCE, Entomologist in Charge, Fruit Investigations, Bureau of Entomology; and M. B. WAITE, Pathologist in Charge, Fruit-Disease Investigations, Bureau of Plant Industry

CONTENTS

Page
Purpose of Investigation 1
Results of Previous Investigations 1
Experimental Work 16
Results of Experimental Work 18
Summary 58
Literature Cited 58

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 1027

Contribution from the Bureau of Chemistry
W. G. CAMPBELL, Acting Chief

Washington, D. C. ▼ April 17, 1922

POISONOUS METALS ON SPRAYED FRUITS AND VEGETABLES.

By W. D. LYNCH, *Assistant Chemist*, C. C. McDONNELL, *Chief, Insecticide and Fungicide Laboratory*, and J. K. HAYWOOD, *Chief, Miscellaneous Division, Bureau of Chemistry;* A. L. QUAINTANCE, *Entomologist in Charge, Fruit Investigations, Bureau of Entomology*; and M. B. WAITE, *Pathologist in Charge, Fruit-Disease Investigations, Bureau of Plant Industry.*[1]

CONTENTS.

Page.
Purpose of investigation 1
Results of previous investigations 1
Experimental work 16
Results of experimental work 18
Summary 58
Literature cited 58

PURPOSE OF INVESTIGATION.

In the spring of 1915 a cooperative study was undertaken in the United States Department of Agriculture to ascertain the amounts of arsenic, lead, and copper remaining on fruits and vegetables treated with poisonous sprays. The spraying was done under the direction of the Bureau of Entomology and the Bureau of Plant Industry, and the chemical work by the Bureau of Chemistry. The plan was to spray various fruit trees and vegetables according to accepted schedules, and also with excessive amounts of material to determine how much of the metals may be present under adverse conditions. In case the investigation showed that poisonous metals remained on the fruit in amounts which might prove injurious to the consumer, the results would constitute a basis for so changing or regulating the spraying schedules as to eliminate this danger.

RESULTS OF PREVIOUS INVESTIGATIONS.

Arsenical compounds first appeared as insecticides in the United States (63)[2] about 1860, when Paris green was used to check the ravages of the Colorado potato beetle. In 1872 Le Baron (70) suggested the application of Paris green to fruit trees to combat the spring cankerworm, but Lodeman (75) states that only a few of the most progressive orchardists adopted arsenical spraying against the codling moth until after the establishment of the State agricultural experiment stations resulting from the passage of the Hatch Act in 1887.

---

[1] Credit is due to John G. Fairchild and Wilbur A. Gersdorff for assistance in the analytical work reported in this paper.

[2] Figures in parentheses refer to Literature Cited, pp. 58 to 66.

The question soon arose as to the possible danger to the consumer from the use of potatoes the vines of which had been treated with a poisonous compound, such as Paris green. One of the first investigators of this subject, Kedzie, in 1872 (64) and 1875 (65), concluded "that there is but very little danger of the potato tuber being poisoned so as to endanger the health of the consumer. Arsenic is equally deleterious to the vegetable as well as the animal system. If added in dangerous quantity to the plant, the plant dies, no potatoes are formed." McMurtrie (78) detected no arsenic in potatoes which had been subjected to applications of Paris green.

Lodeman (75) states that London purple was recommended as an insecticide in 1877. Cook (26), who sprayed apple trees on May 25 and June 20, 1880, at the rate of 1 pound of London purple to 100 gallons of water, reported that 100 blossom ends cut from the sprayed trees on August 19 showed no trace of arsenic. He proved also (27) that it took but a very small amount of the arsenites to kill potato beetles, currant slugs, and cabbage caterpillars, and discovered that the poison was retained on plants sheltered from rain for 10 to 20 days. He concluded that it was safe to use Paris green or London purple on trees the fruit from which would not be eaten for four or five weeks after the application.

Wheeler (132), in 1888, reported that it was safe in California, where rainless summers prevail, to spray vines with Paris green. When the vines were sprayed with 1 pound of Paris green to 16 gallons of water, "ten times as strong as the solution recommended for general use," Rising (114), the State analyst, found only traces of arsenic on the grapes and none in the wine made therefrom.

Objection was offered to the use of arsenicals, on the ground that they frequently caused more or less injury to the foliage. Gillette (58), however, found that "lime added to London purple or Paris green in water greatly lessens the injury that these poisons would otherwise do to foliage." Weed (129) recommended applying insecticides and fungicides together, and Gillette (58) showed that London purple can be used at least eight or ten times as strong without injury to foliage if applied in common Bordeaux mixture instead of in water. Gillette (59) stated, in 1891, that a mixture of 1 ounce of Paris green to 100 ounces of flour was the most effectual remedy against the cabbage worm, applying "just enough to make a slight show of dust upon the leaves." These discoveries were quickly adopted in practice, and arsenicals were generally accepted as the best destroyers of external chewing insects.

The most important insecticides recommended, other than Paris green and London purple, were Scheele's green (113) in 1875, white arsenic plus lime (67) in 1891, and lead arsenate (40) in 1893. Until recently Paris green and lead arsenate have been the most extensively used, but calcium arsenate, now on the market, promises to become one of the leading arsenical insecticides.

The use of Bordeaux mixture originated in France near the city of Medoc. Viticulturists noticed that the vines near the highways, which had been sprinkled with a paste of milk of lime and copper sulphate to prevent thieving, did not suffer from mildew. Prof. Millardet, in 1882, attributed the beneficial action to copper, and later proposed a mixture of copper sulphate, lime, and water, since known as Bordeaux mixture (88) (89). The mixture was immediately accepted not only in France but in the United States, where F. Lamson Scribner (116) was probably the first to publish a formula for it as a result of the work in France. Its use has been extended to the prevention of so many plant diseases that to-day it is perhaps the most important fungicide.

When copper compounds were recommended as fungicides, the question arose as to whether or not spraying with them would leave a dangerous amount of copper on the grapes or in the wine.

Perrett (107) stated, in 1885, that there would be no danger of introducing copper into wine made from grapes sprayed with copper salts, because the hydrogen sulphid formed during fermentation would precipitate the copper as the insoluble sulphid. Quantin (111), in 1886, concluded that the reduction of the sulphate of copper by the ferments was sufficient to effect the total elimination of the copper in wine, but that aeration of the lees which inclosed the precipitated sulphid of copper should be avoided. Chuard (23) announced in 1887 that the copper was present in the must as copper malate, but that it was precipitated during fermentation as the sulphid and tartrate.

In October, 1885, Millardet and Gayon (90) obtained the following amounts of copper from vines that had been sprayed with Bordeaux mixture in July:

Fresh leaves (mg. per kgm.)	19. 1–95. 5
Vine branches (mg. per kgm.)	5. 8
Grape stalks (mg. per kgm.)	15. 0–18. 6
Marcs (mg. per kgm.)	11. 1–21. 9
Musts (mg. per liter)	1. 0– 2. 2
Wines (mg. per liter), from doubtful traces to less than	0. 1

The same authors, in 1886, report (56) the following amounts of copper at vintage from vines treated with various copper mixtures:

Grapes (mg. per kgm.)	0.2–12.6
Must (mg. per liter)	.0–11.8
Wine (mg. per liter)	Fraction.

Examination of wines from different places in the southwest of France showed the presence of copper in the following amounts:

First wines:	
White (mg. per liter), less than	0.01–1.0
Red (mg. per liter), less than	.01–2.8
Second wines (sweet wines) (mg. per liter)	.01– .3
Press wine (mg. per liter)	.05–1.7
Piquettes:	
Normal (mg. per liter)	.0–0.75
Sour (mg. per liter), less than	.01– 1.6

They attributed the absence of copper in wine to the action of the fermentation, the tannin and sulphur added to the wines before fermentation favoring the purification of the wine.

Crolas and Raulin (28) determined the amount of copper in the products of vines that had been treated six weeks to two months before vintage with different preparations containing copper, and found copper in the following amounts:

Grapes (mg. per kgm.)	1.5– 3.5
Marcs (mg. per kgm.)	.9– 12.8
Lees (mg. per kgm.)	49.0–130.0
Piquettes (mg. per liter)	.0– .14
Wines (mg. per liter)	.0– .36

Other investigators who have determined the amount of copper in wine (8) (16) (25) (29) (36) (41) (42) (45) (79) (104) (108) (118) (134) agree that the amount found in every instance was too small to be harmful.

C. L. Penny (105) reported, in 1889, 2.4 and 6.2 parts of copper per million for grapes that had been sprayed with Bordeaux mixture and 1 to 1.3 parts of copper per million for unsprayed grapes. These amounts were less than those found in some common articles of food. In 1890 (106) grapes so heavily sprayed that "either the appearance or the taste of the fruit would have condemned it on the market" were shown by Penny to contain about 47 parts of copper per million, "less than has been found in some articles of food admitted to be healthful, as beef liver."

In order to determine "whether there is any danger to be apprehended from eating grapes which have been sprayed with the Bordeaux mixture and other copper solutions," Galloway and Fairchild (47) gathered grapes from a plat which had been sprayed eight times with Bordeaux mixture. "The last spraying was made on these vines July 30, and between that date and August 28, the date of harvest, only a few slight rains had fallen. The fruit showed the mixture plainly, more pronouncedly in fact than any treated grapes seen in the market. One kilogram of the clusters (2½ pounds), including the stems, which appeared to have the greater part of the copper, * * * yielded 0.005 gram (0.077 grain) of metallic copper," on analysis, about 0.035 grain of copper per pound of grapes.

In September, 1891, the Board of Health of New York City seized a quantity of grapes some of which had been heavily oversprayed with Bordeaux mixture (46). The following results of analysis of the most heavily sprayed bunches of grapes obtainable from the vineyards from which the grapes seized had come were reported (128):

(1) The amount of copper, estimated as metallic copper, found on the berries was very constant in the different samples, averaging 1/120 grain for each pound of fruit (berries and stems).

(2) The amount of copper, estimated as metallic copper, found on the stems varied from 1/90 to 1/14 grain for each pound of fruit (berries and stems), and averaged 1/30 grain.

(3) If the copper were on the berries in the form of sulphate of copper, each pound of berries would contain about 1/30 grain of copper sulphate.

(4) As a matter of fact, copper, when found upon sprayed grapes in New York State, exists, not in the form of a sulphate, but in the form of a carbonate or hydroxid, both of which are not readily soluble and would, therefore, be even less dangerous than if present in the form of sulphate of copper. Most of the copper found was on the stems, and the rest of the copper was on the outside of the skin of the berries, which most people do not eat.

(5) The results obtained from estimating by chemical analysis the amount of copper on grapes, which were selected as being the worst sprayed that could be found, therefore, seem to justify the assertion that it is simply an absolute impossibility for a person to get enough copper from eating grapes to exert upon the health any injurious effect whatever.

According to Popenoe and Mason (109), "as much of the fruit (grapes) at the time of ripening showed a greenish-blue discoloration from the deposit of lime and copper, which had been applied twice since a rain had fallen, some persons feared that it might be poisonous." Analysis of those grapes showing the heaviest deposit gave for combined stems and berries 0.00188 per cent copper, or 0.52 grain of copper sulphate per pound of grapes. "A short time after this sample was taken a heavy shower washed off so much of the deposit that little of the remaining fruit was injured in appearance." Wheeler (131) found only slight traces of copper on grapes that had been sprayed with Bordeaux mixture. Alwood (6) reported no copper, or only traces, on grapes that had been sprayed with copper mixtures, and concluded "that these fungicides are perfectly harmless to consumers of the treated fruit." Maynard (84) reported that only 0.002 per cent of copper oxid was found on grapes which had been so heavily sprayed with Bordeaux as to be badly disfigured and that no trace of copper could be found on grapes which had been properly sprayed with copper mixtures. From this it would seem "that even under the most careless use of the copper solutions, no injurious effects need be feared, and that when properly applied there will not be a trace of copper left upon the fruit at harvesting."

In 1892 the United States Department of Agriculture (9) published the following:

> We take the ground that fruit sprayed with the copper compounds in accordance with the directions of the department is harmless. * * * For five years the copper compounds have been used by hundreds and thousands of fruit growers in every part of the United States, yet in all that time not a single authenticated case of poisoning, so far as we are aware, has been brought to light. * * * Accepting, then, 0.5 gram as the maximum amount of copper in any of the forms discussed that may with safety be daily absorbed, * * * that grapes sprayed intelligently rarely contain more than 5 milligrams (0.005 gram) of copper per kilogram, the average being from 2½ to 3 milligrams per kilogram, * * * an adult may eat from 300 to 500 pounds of sprayed grapes per day without fear of ill effects from the copper. This shows how ridiculously absurd are the statements that fruits properly sprayed with the Bordeaux mixture or any other copper compound are poisonous. * * *
>
> According to numerous analyses, wheat may contain from 4 to 10 milligrams of copper per kilogram. * * * We do not see how any foreign country can logically object to American fruits on the ground that they contain copper without also objecting to wheat.
>
> Wheat, however, does not contain anything like as much copper as some other foods and drinks. Beef liver and sheep liver, according to reliable and repeated analyses, contain, respectively, from 56 to 58 and 35 to 41 milligrams of metallic copper per kilogram of fresh substance, while in chocolate the enormous amount of 125 milligrams to the kilogram has been found. In conclusion, it is only necessary to call attention to one other matter to show how unjust and discriminating it would be to condemn American fruits on the ground that they contain copper in unwholesome quantities. Analyses of vegetables that have been regreened by the copper process show that they may contain from two to sixty times as much of the metal as sprayed grapes.

In this connection the presence of copper reported in various foodstuffs in the following amounts is of interest:

> From 4 to 10 milligrams per kilogram in wheat (43); 56 to 58 milligrams per kilogram in beef liver (105); about 40 milligrams per kilogram in sheep liver (35) (100); from 5.6 to 20.8 (44) and from 5 to 125 (31) milligrams per kilogram in chocolate; from 11.2 to 29.2 (44) and from 9 to 40 (31) milligrams per kilogram in cocoa; from 35 to 250 milligrams per kilogram in cocoa shells (31). Instances are cited (77) where as much as 270 milligrams of copper per kilo was found in French peas that had been subjected to the regreening process. Tschirch stated (127) that copper is widely distributed in plant and animal bodies, always, however, in small amounts; that it enters the animal bodies through food and dust; but that the presence of copper in the bodies of man and other higher animals is not to be considered as "normal." He stated further that plants absorb only small amounts of copper from the ground; that no danger to health need be expected from the consumption of wine from sprayed grapes or of potatoes from sprayed fields, and that even the must of coppered grapes may be eaten and the skins (containing 0.006 gram of copper per kilo) used as fodder; that spraying with copper against fungous diseases might be continued without fear of harm; that only very small quantities of the copper compounds entering the mouth

are taken up by the blood, and poisoning can occur only if the necessary quantity enters the circulation; and that to forbid copper in foods and drinks is to forbid those plants which take it up from the ground, and also to designate the use of bread and chocolate as dangerous to the health.

Lehmann reported the following amounts of copper per kilogram in various plant and animal substances: In wheat, 7.5 milligrams; in cherries, 1.5 milligrams; in pears, 0.5 milligram; and in beef liver, from 6.4 to 59 milligrams (71) (73). He stated (72) that the species of the plant had far less influence than the quantity of the copper in the soil on the amount taken up by the plant.

In 1891 objections to the use of American apples because of the presence on them of arsenic were made in certain British journals. However, Maynard (85), Munson (97), and Fletcher (38) proved that the objection had no basis in fact, and later (10) (103) (126) it became apparent that such objections to sprayed fruit in England were neither very general nor very deep-seated.

Table 1 shows the amount of arsenic and copper found by R. C. Kedzie (66) on fruit sprayed with Bordeaux mixture and London purple in 1892 and 1893.

TABLE 1.—*Arsenic and copper on fruit sprayed in 1892 and 1893 with Bordeaux mixture and London purple (Kedzie).*

Fruit.	Date sprayed.	Date picked.	Spray used.	As_2O_3.	$CuSO_4.5H_2O$.
	1892.	1892.		*Grains per pound.*	
Strawberries	June 18, 23	June 24	6–4–32 Bordeaux, 1 pound London purple, 200 gallons water.	0.0440	4.870
Do	do	do	2–1½–32 Bordeaux, 1 pound London purple, 200 gallons water.	.0298	1.821
Red cherries	June 18, 30	July 6	6–4–32 Bordeaux, 1 pound London purple, 200 gallons water.	.0882	.390
Do	do	do	2–1½–32 Bordeaux, 1 pound London purple, 200 gallons water.	.0250	.252
White cherries	June 30	July 1	6–4–32 Bordeaux, 1 pound London purple, 200 gallons water.	.1210	....
Red currants	May 25, June 7, 18, 30.	July 8	London purple	.0503	....
Raspberries	June 6, 28, July 8.	July 20	2–1½–32 Bordeaux, 1 pound London purple, 200 gallons water.	.0098	.028
Gooseberries	June 18, 29, July 8, 22.	Aug. 2	6–4–32 Bordeaux, 1 pound London purple, 200 gallons water.	.0233	.601
Do	do	do	do	.0372	.362
Pears	June 15, July 7, 21, Aug. 7.	Sept. 6	do	.0088	.0738
	1893.				
Do	May 15, June 12, July 10.	....	No London purple, 2–2–32 Bordeaux.	....	.100
Russian cherries	May 14, June 10, 18, July 15.	....	First 3 dates, 2–2–32 Bordeaux; last date, "eauceleste."	....	.147
Plums	do	....	do	....	.200

The skins from 1 pound of the sprayed pears gave 0.106 grain and the flesh gave 0.071 grain of copper sulphate, "showing that while most of the copper salt adheres to the surface, a portion finds its way into the body of the fruits."

In 1893 Davis (30) reported the determinations of arsenic on celery that had been sprayed with Paris green at the rate of 1 pound to 175 gallons of water. The results, obtained on the celery washed without separating the stalks and prepared as for market, were as follows: Sprayed once, 0.0244 grain of arsenious oxid per pound of celery; sprayed twice, 0.0368 grain of arsenious oxid per pound of celery.

In 1893 Beach reported (12) the presence of from 0.00042 to 0.001 per cent of copper in celery that had been sprayed with Bordeaux or ammoniacal copper carbonate solution, and 0.00081 per cent in unsprayed celery, concluding that "these investigations show that when this sprayed celery was stripped and ready for market the sprayed plants were no more poisonous than the unsprayed."

In 1894 Kinney (68) stated that the skins and stems of pears which had been sprayed five times with Bordeaux mixture (6 pounds of copper sulphate, 4 pounds of lime, and 22 gallons of water), and upon which the spray was still visible at harvest contained only 0.016 grain of copper oxid per pear, for which reason no serious objection to this treatment could be raised from a hygienic standpoint.

In 1894 Garman reported (49) that the skins and ends of six apples from a tree that had been sprayed once with London purple and five times with Paris green at the rate of 1 pound to 160 gallons of water showed on analysis no arsenic and only an unweighable amount of copper. The flesh and cores of these apples gave no reaction for arsenic or copper. He reported also (50) that cured tobacco which had been sprayed with arsenites, at the rate of 1 pound to 160 gallons of water, gave on analysis 0.077 grain of arsenious oxid and 0.042 grain of copper oxid per pound with one spraying with Paris green; 0.133, 0.259, and 0.329 grain of arsenious oxid and 0.126, 0.210, and 0.322 grain of copper oxid per pound with two sprayings with Paris green; and 0.245 grain of arsenious oxid per pound with two sprayings with London purple. Later (1904) this author stated (51) that arsenites such as Paris green can be used on cabbage without leaving a trace sufficient for recognition by the chemist. In 1901, cabbages which had been sprayed with Paris green or lead arsenate showed on analysis "traces of poison present." In 1902, and again in 1903, sprayed cabbages were analyzed, but the chemist "was unable to find a trace of poison present."

In 1897 Teyxeira (123) found from 20 to 50 milligrams of copper in 1 kilogram of juice from tomatoes that had been sprayed with copper sulphate, and none after treatment with Bordeaux, unless the skin was cracked. He stated that the copper sulphate penetrates the skin into the flesh, but that the copper-lime mixture does not.

In 1898 Hoffmann reported (62) the presence of from 0.0046 to 0.0128 gram of copper per liter in wines, but failed to give the history of the samples. Later he reported 0.00096 and 0.0058 gram of copper per liter in wine, 0.0028 and 0.0056 gram of copper per liter in must, 0.0027 and 0.0045 gram of copper per liter in grape-skin wine, and 0.053 gram of copper per 100 grams in the grape skins.

Selby found (117) 0.0004 gram of copper per 100 grams of grapes to be the maximum amount on the samples he examined. To show that sprayed grapes can be safely used for making wine he cites Krüger (69), "that in the different musts different amounts of copper, at the beginning of fermentation, or just before the beginning, enter into an insoluble and consequently an inert (copper) compound, in consequence of the presence of greater or less amounts of organic acids. From this condition it is likely that the copper of the must, arising from the spraying of the grapes, is without any importance for the wine."

Gibbs and James (57) reported that 292 of 352 samples of wine examined contained no arsenic, 58 contained from a trace to 1 part in 8,000,000, 1 contained 1 part in 5,000,000, and another 1 part in 2,500,000. They stated also that of 200 samples of wine examined by C. S. Ash the three highest in arsenic contained 1 part in 6,000,000, 1 part in 8,000,000, and 1 part in 14,000,000. "The most probable sources of the major part of that found are arsenical sprays when used upon the vines, sulphur burned for the purpose of sulphuring the wines and receptacles, and perhaps to some extent the lead shot used in cleaning the bottles." A sample of sulphur from a California winery was found to contain arsenic in the proportion of 1 part in 5,000. It is not stated whether these wines were the product of sprayed vines.

In 1906 Roger Marès (82) reported that he found no trace of arsenic in wine from a vine treated a month before grape gathering with a copper-arsenical mixture, and he accordingly continued to recommend this combined mixture as a spray for the vines in Algiers. The same year Von der Heide (61) reported the results shown in Table 2 on products of vines that had been sprayed with lead arsenate.

TABLE 2.—*Metals on products of vines sprayed with lead arsenate (Von der Heide).*

	Arsenic.	Lead.	Copper.
Grapes (bunches) (milligrams per 100 grams)	0.3	0.7	....
Grapes (individual) (milligrams per 100 grams)	.2	.3	....
Stems (milligrams per 100 grams)	7.1	10.6	....
Leaves (milligrams per 100 grams)	16.0	48.0	27
Grape skins (milligrams per 100 grams)	.7– .6	1.4– .8	....
Must (milligrams per 100 grams)	.3	.8	....
Fall wine (milligrams per 100 grams)	.2	.6	....
Spring wine (milligrams per 100 grams)	.1	.2	....
Wet lees (milligrams per 100 grams)	3.0	4.8	....
Dry lees (milligrams per 100 grams)	12.9	20.7	....

The German Imperial Health Commission was opposed to the use of lead arsenate in the spraying of grapes because arsenic and lead were found in the wine.

In 1907 Szameitat (121) (122) reported the following results of analyses of musts, wines, and grapes from vines sprayed with arsenic compounds: From a trace to 0.9 milligram of arsenic in 300 grams of grapes; none to 0.14 milligram of arsenic in 300 cubic centimeters of must; none or only a trace in 300 cubic centimeters of wine. Of 38 samples of German wine examined, 24 showed small amounts of arsenic, the largest amount being 0.05 milligram in 100 cubic centimeters of wine. The source of arsenic was not identified.

The use of arsenic compounds for the destruction of insects that devastated vines having become more or less general in central France, in spite of the fact that the French ordinance of 1846 prohibited the use of arsenic for the destruction of insects, the question arose as to the danger of such use.

In 1907 Bertin-Sans and Ros (14), who were among the first in France to publish an answer to this question, found less than 0.001 milligram of arsenic in 145 grams of unripe grapes gathered one month after spraying with sodium arsenate, and 0.002, 0.001, 0.030, and 0.040 milligram of arsenic per liter in wine from arsenical treated vines. These investigators stated that as sheep and cows were not admitted to the sprayed vines and were not fed the sprayed foliage until after harvest there was no danger to these animals, but that rabbits and snails might be poisoned by eating sprayed foliage, and, since snails can tolerate a fairly large amount of arsenic, persons should refrain from eating them during the spraying season. As lead is a cumulative poison, it was considered more prudent to use arsenicals other than lead arsenate, although no data existed to show that there was danger in the use of lead arsenate as an insecticide. Bertin-Sans and Ros believed that the chief danger in the use of arsenicals arose from mistakes due to carelessness and that if suitable regulations were enforced no danger was to be feared. Since the ordinance of 1846 was a dead letter, it seemed to them much better to have the arsenicals handled under definite regulations. In 1908 (15) they stated that as they had found only traces of arsenic in wine from vines sprayed with arsenicals, there was no ground for the fear that the arsenic would pass into the wine if the vines had been sprayed before the grapes were in bloom.

In 1909 Truelle (125) (126) concluded that the advantages of arsenical spraying were so great that its use under regulation should be authorized in France.

Cazeneuve (21), thinking that the use of arsenical insecticides was a serious menace to the public health, asked (1908) for the strict enforcement of the ordinance of 1846. Riche (112) and Gautier (52), on the other hand, believed that the use of arsenicals, with the exception of lead arsenate, should be permitted in agriculture, but only under proper regulation.

In 1909, a committee appointed by the Academy of Medicine (1) (21) (112) to study this question recommended (96) the strict enforcement of the ordinance, thus causing a very lively discussion. Weiss (130), believing that the committee did not have sufficient evidence to substantiate its recommendation, proposed a medical investigation, this proposal being adopted (2) and sent to the minister of the interior as the advice of the academy. A year later the academy asked (32) that a new investigation, essentially medical, be carried on for two years, and, to avoid accidents, recommended strict regulations in the use of arsenicals and the complete exclusion of lead arsenate. The direction of the investigation was to be intrusted to the councils of hygiene and the sanitary commissions of each department, after consultation with the professors of agriculture (33). In 1911, dissatisfied with the lack of enforcement of its suggestions, the academy decided (34) to recall to the public powers the conditions they had recommended as to the use of arsenicals in agriculture. Malvy, undersecretary of state, stated (80) that since the investigation conducted by the minister of the interior had disclosed no accident, either among the workers who handled the arsenicals or among the consumers, to prohibit the use of lead arsenate would be to impose useless annoyances on merchants and viticulturists. In 1913 the minister of the interior submitted to the Academy of Medicine a draft of a decree carrying modifications of the ordinance of 1846, permitting the use of insoluble arsenicals in agriculture (3).

After much discussion (5) (22) (53) (54) (76), articles 9 and 10 of the draft, authorizing the use of arsenicals in agriculture under specified regulations, were adopted by the academy (4) (5), with the recommendation that the order of the minister of agriculture dealing with the precautions to be taken in their use should apply to all arsenicals and not merely to lead arsenate, and article 11, which prohibited the sale and use of soluble arsenic salts, was amended to permit their sale when "denatured" (5). The academy also voted (5) that the public powers be requested to take every means to inform the public of these regulations and to impose penalties for their infraction, and that the Government be requested to encourage researches to find substitutes for arsenicals. The French decree authorizing the use of insoluble arsenicals in agriculture, under regulation (81), and the minister of agriculture's instructions for the sale and use of these arsenical compounds were published in 1916 (86). The sale and use of *soluble* arsenicals as insecticides were prohibited.

Breteau (17) analyzed 15 samples of wine from vines sprayed with arsenicals, finding from none to 0.04 milligram of arsenic per liter in

12 of the samples and 0.1, 0.1, and 0.2 milligram of arsenic per liter in the other three. He attributed the higher content of arsenic in the last three samples to the fact that the wines had been sulphured. If, as held by Gautier and Clausmann (55), a normal wine contains about 0.01 milligram of arsenic, he felt that the arsenical treatment of vines will introduce into the wine less than 0.03 milligram of arsenic per liter. Mestrezat (87) considered that the only danger from the use in viticulture of arsenical insecticides occurs when they are placed near other substances which resemble them so closely as to be easily mistaken for them. In 1906 Forbes (39) reported 36.6 and 32.9 parts of arsenious oxid per million in peelings of apples sprayed the preceding day with lead arsenate and 40.1 parts of arsenious oxid per million in peelings of apples gathered two months after being sprayed heavily with lead arsenate. He considered that lead arsenate could be substituted for the more common insecticide sprays if discretion were exercised in its use. In 1910 Günther (60) reported the results given in Table 3 on fruits that had been sprayed once with a mixture containing 300 grams of sodium arsenite and 425 grams of lead acetate per 100 liters.

TABLE 3.—*Residue on fruits sprayed once with mixture containing 300 grams of sodium arsenite and 425 grams of lead acetate per 100 liters (Günther).*

	Days elapsed after spraying.	Arsenic.	Lead.
		Milligrams per 100 grams.	
Gooseberries	39	1.000	2.16
Currants	39	7.140	16.70
Pears	80–106	.123	....
Apples	80–106	.074	Trace.
Do	80–106	.057	0.017

He reported the results given in Table 4 on fruits dusted once with a mixture consisting of 2 parts of freshly slaked lime, 4 parts of sulphur, and 1 part of Paris green.

TABLE 4.—*Residue on fruits dusted once with a mixture consisting of 2 parts of freshly slaked lime, 4 parts of sulphur, and 1 part of Paris green (Günther).*

	Days elapsed after dusting.	Arsenic.	Copper.
		Milligrams per 100 grams.	
Gooseberries	39	0.8300	0.560
Do	39	2.1200	.930
Currants	39	1.6100	....
Do	39	1.5300	.870
Pears	80–106	.0720	.240
Apples	80–106	.0420	.067
Do	80–106	.0084	.095
Do	80–106	.0420	.011
Sweet cherries	24	.2000	.160
Sour cherries	24	.3200	.250
Plums	24	.5000	Trace.

In 1910 Bedini (13) reported from 0.2 to 0.4 milligram of arsenious oxid per kilogram in the skins of pears that had been sprayed with arsenate of iron, and only a trace of arsenic in the pulp. The same year Porchet (110) reported that pears sprayed with lead arsenate contained as much as 0.3 milligram of arsenious oxid per kilogram in both the pulp and the skin; that the skins of unsprayed pears contained 0.035 milligram of arsenious oxid per kilogram of fruit; that sprayed grapes contained traces of arsenic, apparently the same in the interior as on the exterior of the fruit, the highest amount obtained being 0.2 milligram per kilogram of grapes; and that the traces of arsenic passed from the grapes into the must, but that the arsenic was precipitated as sulphid during the fermentation. Chuard (24) also found that the arsenic in the must was precipitated as sulphid during the fermentation.

Fetel (37), in 1910, reported that 10 samples of grapes bought on the market in Algeria on August 8 and 25, September 1 and 19, and October 3 contained an average of 0.038 milligram of arsenic per kilogram, while unsprayed grapes, collected on August 8 and September 1 and 8, contained no arsenic. Grapes sprayed twice before blossoming, with a Bordeaux-sodium-arsenate mixture, and gathered on August 10 and 25 and September 5 and 22, contained, respectively, 0.185, 0.083, 0.074, and 0.074 milligram of arsenic per kilogram. Grapes sprayed twice before flowering with arsenious acid and on July 24 with Bordeaux-arsenious-acid mixtures, and gathered on July 24 before and after this last spraying, on August 22, and on September 15, contained, respectively, 0.056, 0.467, 0.149, and 0.112 milligram of arsenic per kilogram.

In 1909 and 1910 Brioux and Griffon (18) found 0.001, 0.001, and 0.004 milligram of arsenic per kilogram in three lots of pears that had been sprayed with a Bordeaux-lead-arsenate mixture. They also reported that, although apples which had been sprayed with lead arsenate on June 8 and June 22, 1910, contained when examined in July 1.3 milligrams of arsenic and 14.2 milligrams of lead per kilogram, yet in September, at harvest time, the apples and the cider contained no lead and only traces of arsenic.

Moreau and Vinet (92), in 1910, reported that grapes sprayed with lead arsenate on May 27 and June 6 contained, respectively, on June 22 and September 14, about 2 and 0.28 milligrams of lead arsenate per bunch, and that 165 grams of moist lees contained 1.38 milligrams of lead arsenate, but that the wines contained no lead or arsenic. They found (93) that only 1 per cent of the lead arsenate which they had applied on May 31 was retained by the grapes, 0.58 milligram per bunch, and that with the development of the grapes a second spraying was necessary on June 14 to control the first generation of the cochylis larva. They also found that a spraying on August 6 to control the second generation of this insect adhered mostly to the stems. They concluded from other experiments (94) that, since grapes sprayed twice with lead arsenate before flowering, on May 31 and June 14, showed no lead or arsenic at harvest time, October 15, there would be no danger in consuming grapes sprayed so early, but that, since grapes sprayed after the flowering period, on August 6, showed 0.40 milligram of lead arsenate per 100 grams of grapes at harvest time, October 27, there might be danger in consuming grapes sprayed so late in the season. They reported further (95) that wines from vines treated before the flowering period with lead arsenate could be consumed without danger, since only faint traces of lead and arsenic were found in wines from such vines and that the lead and arsenic were eliminated during the process of the making of the wine, being found principally in the marc and in small amounts in the lees.

In 1911 Ampola and Tommasi (7) stated that foodstuffs derived from plants treated with arsenical compounds always contain arsenic, usually in traces, but sometimes as much as 2 milligrams or even more per kilogram in fruits and 1.5 milligrams per liter in wine, amounts greater than that allowed by the Royal Commission on Arsenical Poisoning in England (11) (115).

In 1912 Muttelet and Touplain (99) reported that the grapes, marcs, wines, piquettes, and lees which came from vines treated with lead arsenate contained about the same amount of arsenic as was found in the products from vines not treated, that the wines and piquettes contained no lead, but that the lees in certain cases contained an appreciable quantity of lead, in which cases there was danger in the consumption of wine or piquette before the deposition of the lees, and that grapes sometimes retained on their surface a quantity of lead which rendered dangerous their consumption in a natural state. The same year Carles and Barthe (20) reported that the wines from vines sprayed before the formation of the fruit with excess of lead arsenate contained only negligible traces of arsenic and lead and that those from vines normally treated with lead arsenate contained neither arsenic nor lead, but that the lees contained 0.0028 and 0.0004 gram of arsenic per liter and traces of lead. According to Mathieu (83), unsprayed grapes and wines made from them contain only traces of arsenic, grapes from vines sprayed with arsenicals before flowering contain not more than 0.05 milligram of arsenic per kilogram, even in a dry year, red wine made from grapes treated with arsenicals in a year of abundant rain contains only a little more arsenic than wine made from unsprayed grapes, the amount being less than 0.06 milligram per liter, and part of the arsenic in the grapes remains in the marc in making red wines, which wines, however, should not contain more than 0.05 milligram per liter. In 1914 Garino (48) stated that the amounts of arsenic met in analyses of wines from grapes subjected to cupro-arsenical treatment are very small, being less than the minimum therapeutic dose of 5 milligrams, and therefore need cause no alarm.

In 1913 Spallino (120) found in three samples of snuff 0.16, 0.40, and 0.34 milligram of arsenic per 100 grams of dried snuff, and in four samples of smoking tobacco 0.08, 1.02, 0.30, and 0.64 milligrams of arsenic per 100 grams of dry tobacco.

Sonntag (119), in 1914, concluded from the results he obtained on ripe fruits and leaves treated in 1907 and 1908 with arsenical mixtures that the arsenical sprays or dusts applied to fruit trees and bushes adhere to the fruits and are retained by them for a long time, in many cases even until the ripening of the fruit.

O'Gara (101) stated that the skin of apples sprayed with lead arsenate may occasionally absorb some arsenic. In such cases the skin is likely to develop red or black spots. Analysis of such spotted apple skins showed the presence of fractions of a milligram of arsenic. Woods (133) reported that apples sprayed with lead arsenate during the first week in August, 1913, carried upon their surface, about two months after spraying, from one-eighth to one-third milligram of lead arsenate per apple. He concludes that "midsummer spraying with lead arsenate is an effective way of combating the brown-tail moth," and "the amount of arsenic or of lead that will remain at harvest upon the apples that are sprayed in midsummer with arsenate of lead is so slight as to have no practical bearing."

In 1916 Trofimenko and Obiedoff (124) reported that grapes treated with wet arsenical mixtures under conditions most favorable for the continuance of the arsenical salts, both on the grapes and in the must, yielded unobjectionable wines. No arsenic was found in white wine and only 0.0002 gram of arsenious oxid per liter in red wine. The lees might be used for extracting the tartar, washing being enough to remove the arsenates. Muttelet (98) stated that the wine and piquette from vines treated with copper sulphate and lead arsenate, even after the formation of the grapes, contained no lead or copper, and no more than traces of arsenic. The pomace wine contained no lead, traces of copper, and 5 milligrams of arsenic per hectoliter. The lees contained 500 milligrams of lead, 10 milligrams of arsenic, and traces of copper per liter. The air-dried marc contained 200 milligrams of lead, 0.1 milligram of arsenic, and traces of copper per kilogram.

Liberi, Cusmano, Marsiglia, and Zay (74) found copper in the fruit of tomatoes in amounts varying from 0.14 to 2.10 milligrams per kilogram of juice and pulp, and from 3.8 to 19.5 milligrams per kilogram of dry matter. The soils upon which the tomatoes were grown contained copper up to 110 milligrams per kilogram. These investigators stated that the spraying with copper mixtures had no effect upon the copper content of the tomatoes. It appeared that the copper found in the tomatoes came from the soil, whence the plants assimilated it in different proportions, according to the nature of the soil or under the influence of other factors.

In 1917 Carles (19) stated that copper occurs in small amounts in agricultural products and in larger amounts in calf liver and beef liver. O'Kane, Hadley, and Osgood (102) reported the following amounts of arsenic (calculated as As_2O_3) on fruits and vegetables that had been sprayed with dry lead arsenate equivalent to 3 pounds of lead arsenate paste to 50 gallons of water: Apples picked at intervals ranging from 3 to 91 days after spraying, 0.08 to 0.77 milligram per apple when picked carefully, 0.02 to 0.50 milligram when picked in the ordinary way, 0.10 to 0.21 milligram when picked with cotton gloves, and 0.08 to 0.18 milligram when picked with cotton gloves and wiped; strawberries picked 2 and 6 days after spraying, from 8.6 to 34.2 milligrams per quart; currants picked 3, 6, and 8 days after spraying, from 6.8 to 10.2 milligrams per quart; blackberries picked on the day they were sprayed, from 3.8 to 11.2 milligrams per quart; cabbage gathered 2 and 8 days after spraying, from 43.5 to 51.4 milligrams per head; and lettuce gathered 1 and 6 days after spraying, from 1.6 to 10.6 milligrams per head. The maximum amount of lead arsenate spray that would adhere to an apple, when sprayed directly, was found to be an amount equivalent to 4 milligrams of arsenious oxid. Such fruit gave evidence of spray material on its surface.

EXPERIMENTAL WORK.

The investigation conducted by the United States Department of Agriculture included experiments on peaches, cherries, plums, apples, pears, grapes, cranberries, tomatoes, celery, and cucumbers. The spraying schedules are shown in Tables 5 to 14.

METHODS OF ANALYSIS.

The following methods of analysis were employed:

Of the whole fruit and pulp, dry 200 to 300 grams of sample on the steam bath in glass dishes, and report loss as "loss on drying." (For the determinations on the skins, use parings from 4 apples; for the calyx and stem end determinations, use 12 apples and corresponding amounts in the case of other fruits.) Transfer the dried residues to casseroles and add 100 to 200 cc. nitric acid. Heat the mixture, if necessary, to start action, and when violent action is over cautiously add 20 cc. sulphuric acid. Heat on hot plate, removing at intervals to add small amounts (3 to 5 cc.) of nitric acid (do not allow the solution to become black), and when the oxidation is complete evaporate until sulphuric acid fumes are given off. Cool, dilute with water, and again evaporate to sulphuric acid fumes. Cool, dilute with about 100 cc. of 50 per cent alcohol, and let stand over night. Filter and wash with 80 per cent alcohol. Save sulphate precipitate for lead determination. The copper and arsenic are determined in the filtrate. Evaporate the filtrate to small volume on steam bath to remove alcohol. Make to volume.

Arsenic.—Determine arsenic in an aliquot by the Gutzeit method (Bur. Chem. Circ. 102), modified as follows: The aliquot should contain less than 0.08 mg. arsenic. Dilute to 50 cc. Add strong sulphuric acid so as to have 10 cc. present Add 1 gram sodium chlorid to the aliquot in a small Erlenmeyer flask, heat on steam bath to about 90° C., then add 1 cc. of a stannous chlorid solution containing 0.5 gram dissolved in hydrochloric acid, and leave on steam bath for about 5 minutes (temperature near 90° C.). Remove from steam bath, transfer to the 4-ounce generating bottle, dilute to 100 cc., and cool to room temperature. This generating bottle is connected by a rubber stopper with an upright tube 8 cm. long, 1 cm. diameter, containing lead acetate paper. This tube is connected by a rubber stopper with a similar tube containing cotton moistened with 5 per cent lead acetate solution. Connected by a rubber stopper with this tube is a capillary tube 3 mm. in diameter, 12 cm. in length, carrying the strip of mercuric bromid paper. Prepare these strips as follows: Cut heavy, close-textured drafting paper into strips 2 mm. by 12 cm.; then soak them for an hour in 5 per cent alcoholic mercuric bromid solution, take out, rapidly squeeze off excess of solution, separate on glass rods, and allow to dry. Place three pieces of stick zinc (about 10 grams) in the generating bottle and join it immediately to the apparatus tubes. Allow the determination to run for 1½ hours, keeping the temperature down to room temperature by placing the bottle in cool water. From standards plot a curve showing milligrams of arsenic to millimeters in length. As high as 0.08 milligram of arsenic can be read on a paper. Determine the larger quantities of arsenic by passing the arsine into a mercuric chlorid solution and either weigh the mercurous chlorid or titrate the arsenious oxid. (Bur. Chem. Circ. 102, p. 5.)

Copper.—Introduce an aliquot into a 100 cc. Erlenmeyer flask. Neutralize the acid with ammonia, add 2 to 3 cc. hydrochloric acid for every 50 cc. of solution, and saturate the solution with hydrogen sulphid. Stopper flask and let stand over night. Filter off the copper sulphid and wash with hydrogen sulphid water. Place the filter paper containing the copper sulphid in a 50 cc. casserole, burn off the paper, dissolve residue in 5 cc. (1:1) nitric acid, evaporate to dryness, add water and 1 drop ammonia, make faintly acid with acetic acid, and add a few drops of a 2 per cent potassium ferrocyanide solution. Compare with standards.

Lead.—Dissolve the sulphate precipitate, previously referred to, in hot 10 per cent ammonium acetate solution, add 2 cc. (0.1 per cent solution) gum arabic, and make to volume with hydrogen sulphid water in 50 cc. (or 100 cc.) Nessler tubes. Compare the tubes thus prepared with standards made up similarly with gum arabic, ammonium acetate, known amounts of lead, and hydrogen sulphid water.

Where copper alone is to be determined, heat the dried sample cautiously over a Bunsen burner and finally ash at the mouth of the electric-muffle furnace. Add 5 cc. (1:1) nitric acid to the ash, evaporate almost to dryness on steam bath, dilute, and make alkaline with ammonia. Filter off precipitate and wash. Dissolve precipitate, reprecipitate with ammonia, and wash. Evaporate the united filtrates to dryness, add water and one drop ammonia, make slightly acid with acetic acid, and add a few drops 2 per cent potassium ferrocyanide solution. Compare with standards.

The presence of between 0.02 and 0.24 milligram of copper can be determined by this method. Larger amounts may be determined by taking an aliquot, by comparing in ammoniacal solutions, or by electrolysis.

The presence of from 0.02 to 0.24 milligram of lead can be read in the 50 cubic centimeter Nessler tubes, larger amounts by using 100 cubic centimeter Nessler tubes or by taking a smaller aliquot.

The whole and pulp of apples were fumed in 7-inch casseroles and the skins were fumed in 5-inch casseroles, all being transferred to 4-inch casseroles before final fuming. Casseroles were covered until final fuming.

RESULTS OF EXPERIMENTAL WORK.

The results of the chemical analyses appear in Tables 5 to 15, inclusive.

TABLE 5.—*Arsenic and lead remaining on sprayed peaches at picking time.*

Sample No.	Spray material used.[1]	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Arsenic.	Lead.	Loss on drying.	Average weight of peach.
		1915.		*Parts per million.*				*Mg. per peach.*		*P.ct.*	*Gr.*
23196[2]	48 lbs. hydrated lime, 2 lbs. lead arsenate (powder).	May 9[3]	Whole[4].	0.13	0.90	0.40	2.7	0.014	0.042	85.3	105.3
			Pulp....	.06	.40	.20	1.4	.005	.016	85.8	
			Skin....	.42	2.60	1.20	7.3	.009	.026	83.6	
	2 lbs. lead arsenate (powder), 32 lbs. hydrated lime, 16 lbs. sulphur.	May 26									
	16 lbs. sulphur, 34 lbs. hydrated lime.	July 10									
23197[2]	46 lbs. hydrated lime, 4 lbs. lead arsenate (powder).	May 9[3]	Whole[4].	.18	1.30	.40	2.8	.018	.040	85.7	100.5
			Pulp....	.08	.60	.10	.7	.006	.008	86.0	
			Skin....	.61	4.00	1.60	10.4	.012	.032	84.6	
	32 lbs. sulphur, 4 lbs. lead arsenate (powder), 14 lbs. hydrated lime.	May 26									
	32 lbs. sulphur, 18 lbs. hydrated lime.	July 10									
23198[2]	44 lbs. hydrated lime, 6 lbs. lead arsenate (powder).	May 9[3]	Whole[4].	.25	1.80	.80	5.7	.024	.076	85.9	95.2
			Pulp....	.08	.60	.20	1.4	.006	.015	86.1	
			Skin....	.90	6.10	3.00	20.4	.018	.061	85.3	
	44 lbs. sulphur, 6 lbs. lead arsenate (powder).	May 26									
	Sulphur alone..........	July 10									
23199[2]	1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	.20	1.50	.30	2.2	.020	.029	86.2	98.0
			Pulp....	.08	.60	.10	.8	.007	.008	86.7	
	50 galls. self-boiled lime-sulphur, 1 lb. lead arsenate (powder).	May 26	Skin....	.66	4.20	1.10	7.0	.013	.021	84.2	
	Self-boiled lime-sulphur.	July 10									
23200[2]	Check (unsprayed).....	....	Whole[4].	.12	.90	.0	.0	.010	.0	86.7	83.6
			Pulp....	.07	.50	.0	.0	.005	.0	87.0	
			Skin....	.29	2.00	.0	.0	.005	.0	85.3	
23201[2]	78 lbs. terra alba, 32 lbs. sulphur.	May 9[3]	Whole[4].	.13	1.00	.0	.0	.012	.0	86.5	92.2
			Pulp....	.02	.20	.0	.0	.001	.0	87.0	
	Do..................	May 26	Skin....	.63	4.00	.0	.0	.011	.0	84.3	
	Do..................	July 10									
23202[2]	78 lbs. hydrated lime, 32 lbs. sulphur.	May 9[3]	Whole[4].	.10	.80	.0	.0	.009	.0	86.7	88.4
			Pulp....	.09	.70	.0	.0	.006	.0	87.1	
	Do..................	May 26	Skin....	.14	.90	.0	.0	.003	.0	85.0	
	Do..................	July 10									
23203[2]	10 lbs. lead arsenate (powder), 90 lbs. hydrated lime.	May 9[3]	Whole[4].	.13	.90	.30	2.1	.013	.030	85.4	101.8
			Pulp....	.08	.60	.20	1.4	.007	.017	85.8	
			Skin....	.35	2.10	.70	4.4	.006	.013	84.2	
	Do..................	May 26									
23204[2]	8 lbs. sulphur, 3 ozs. glue (used in water to wet sulphur), 8 lbs. hydrated lime, 1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	.10	.70	.30	2.0	.009	.025	85.1	86.0
			Pulp....	.04	.30	.10	.7	.003	.007	85.4	
			Skin....	.34	2.10	1.00	6.3	.006	.018	84.1	
	Do..................	May 26									
	8 lbs. sulphur, 3 ozs. glue (used in water to wet sulphur), 8 lbs. hydrated lime, 50 galls. water.	July 10									

---

[1] Where no mention is made of water in the formula the material was applied as dust.
[2] Delaware variety, harvested Aug. 12–18, Berlin, Md.
[3] As shucks fell.
[4] Without stones.

TABLE 5.—*Arsenic and lead remaining on sprayed peaches at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic(As).		Lead (Pb).		Arsenic.	Lead.	Loss on drying.	Average weight of peach.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.				
		1915.		*Parts per million.*				*Mg. per peach.*		*P.ct.*	*Gr.*
23205[2]	Sprayed lightly with 1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	0.16	1.20	0.30	2.2	0.013	0.025	86.1	84.1
			Pulp....	.04	.30	.10	.7	.003	.007	86.3	
			Skin....	.60	4.10	1.00	6.8	.010	.018	85.3	
	8 lbs. sulphur, 8 lbs. stone lime, 50 galls. water (self-boiled lime-sulphur), 1 lb. lead arsenate (powder).	May 26									
	Self-boiled lime-sulphur.	July 10									
23206[2]	Sprayed heavily with 1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	.30	1.90	.70	4.4	.021	.049	84.0	69.5
			Pulp....	.06	.40	.30	1.9	.003	.016	84.2	
			Skin....	1.30	7.80	2.50	15.1	.018	.033	83.4	
	8 lbs. sulphur, 8 lbs. stone lime, 50 galls. water (self-boiled lime-sulphur), 1 lb. lead arsenate (powder).	May 26									
	Self-boiled lime-sulphur.	July 10									
23207[2]	Commercially sprayed with 1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	.23	1.50	.60	4.0	.019	.050	85.0	83.4
			Pulp....	.04	.30	.20	1.3	.002	.013	85.1	
			Skin....	.96	6.30	2.10	13.7	.017	.037	84.7	
	8 lbs. sulphur, 8 lbs. stone lime, 50 galls. water (self-boiled lime-sulphur), 1 lb. lead arsenate (powder).	May 26									
	Self-boiled lime-sulphur.	July 10									
23208[5]	48 lbs. hydrated lime, 2 lbs. lead arsenate (powder).	May 9[3]	Whole[4].	.10	.60	.40	2.6	.008	.035	84.5	81.2
			Pulp....	.03	.20	.20	1.3	.002	.013	84.6	
			Skin....	.36	2.30	1.40	8.8	.006	.022	84.0	
	2 lbs. lead arsenate (powder), 32 lbs. hydrated lime, 16 lbs. sulphur.	May 26									
	16 lbs. sulphur, 34 lbs. hydrated lime.	July 10									
23209[5]	46 lbs. hydrated lime, 4 lbs. lead arsenate (powder).	May 9[3]	Whole[4].	.21	1.40	.70	4.8	.014	.045	85.3	65.8
			Pulp....	.08	.50	.40	2.7	.004	.020	85.4	
			Skin....	.70	4.60	1.70	11.2	.010	.025	84.8	
	32 lbs. sulphur, 4 lbs. lead arsenate (powder), 14 lbs. hydrated lime.	May 26									
	32 lbs. sulphur, 18 lbs. hydrated lime.	July 10									
23210[5]	44 lbs. hydrated lime, 6 lbs. lead arsenate (powder).	May 9[2]	Whole[4].	.67	4.40	1.40	9.1	.040	.083	84.6	59.3
			Pulp....	.09	.60	.20	1.3	.004	.009	84.8	
			Skin....	2.50	15.40	5.10	31.5	.036	.074	83.8	
	44 lbs. sulphur, 6 lbs. lead arsenate (powder).	May 26									
	Sulphur, with 5 per cent hydrated lime added.	July 10									
23211[5]	1 lb. lead arsenate (powder), 50 galls. water.	May 9[3]	Whole[4].	.30	2.00	1.20	7.9	.018	.070	84.8	58.7
			Pulp....	.10	.70	.20	1.4	.004	.007	85.2	
			Skin....	1.00	6.10	4.30	26.1	.014	.063	83.5	
	50 galls. self-boiled lime-sulphur, 1 lb. lead arsenate (powder).	May 26									
	Self-boiled lime-sulphur.	July 10									
23212[5]	Check (unsprayed)......	....	Whole[4].	.02	.13	.0	.0	.001	.0	84.4	67.4
			Pulp....	.00	......	.0	.0	.000	.0	84.8	
			Skin....	.05	.30	.0	.0	.001	.0	82.9	
23213[5]	78 lbs. terra alba, 32 lbs. sulphur.	May 9[3]	Whole[4].	.06	.40	.0	.0	.003	.0	85.1	55.8
			Pulp....	.02	.14	.0	.0	.001	.0	85.6	
	Do...............	May 26	Skin....	.15	.90	.0	.0	.002	.0	83.4	
	Do...............	July 10									

[2] Delaware variety, harvested Aug. 12–18, Berlin, Md.
[3] As shucks fell. [4] Without stones.
[5] Delaware variety, harvested Aug. 12–18, Springfield, W. Va.

TABLE 5.—*Arsenic and lead remaining on sprayed peaches at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic(As).		Lead (Pb).		Arsenic.	Lead.	Loss on drying.	Average weight of peach.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.				
		1915.		*Parts per million.*				*Mg. per peach.*		*P.ct.*	*Gr.*
23214 [5]	78 lbs. hydrated lime, 32 lbs. sulphur.	May 9 [3]	Whole [4]	0.03	0.20	0.0	0.0	0.002	0.0	85.0	52.1
			Pulp	.03	.20	.0	.0	.001	.0	85.5	
			Skin	.06	.36	.0	.0	.001	.0	83.2	
	Do	May 26									
	Do	July 10									
23215 [5]	10 lbs. lead arsenate (powder), 90 lbs. hydrated lime.	May 9 [3]	Whole [4]	.12	.70	.40	2.4	.007	.024	83.4	56.3
			Pulp	.06	.40	.20	1.2	.003	.009	83.5	
			Skin	.40	2.40	1.40	8.2	.004	.015	83.0	
	Do	May 26									
23216 [5]	8 lbs. sulphur, 3 ozs. glue (used in water to wet sulphur), 8 lbs. hydrated lime, 1 lb. lead arsenate (powder), 50 galls. water.	May 9 [3]	Whole [4]	.17	1.10	.40	2.6	.009	.024	84.9	54.6
			Pulp	.05	.30	.20	1.4	.002	.011	85.3	
			Skin	.58	3.50	1.20	7.3	.007	.013	83.5	
	Do	May 26									
	8 lbs. sulphur, 3 ozs. glue (used in water to wet sulphur), 8 lbs. hydrated lime, 50 galls. water.	July 10									
23440 [6]	Sprayed lightly with 2 lbs. lead arsenate (com. paste), 2 lbs. stone lime, 50 galls. water.	June 1	Whole [4]	.18	1.80	.70	6.9	.017	.062	89.8	95.0
			Pulp	.04	.40	.20	2.1	.003	.012	90.4	
			Skin	.72	5.80	2.50	20.0	.014	.050	87.5	
	2 lbs. lead arsenate (com. paste), 50 galls. self-boiled lime-sulphur (8-8-50).	June 19									
	Self-boiled lime-sulphur (8-8-50).	July 29									
23441 [6]	Same as No. 23440, but heavier applications.	Same as No. 23440	Whole [4]	.36	3.70	.90	9.2	.032	.077	90.3	89.3
			Pulp	.07	.80	.20	2.1	.005	.014	90.8	
			Skin	1.37	11.80	3.20	27.6	.027	.063	88.4	
23442 [6]	4 lbs. lead arsenate (com. paste), 4 lbs. stone lime, 50 galls. water.	June 1	Whole [4]	.30	2.90	.80	7.8	.028	.076	89.7	95.1
			Pulp	.06	.60	.20	2.0	.004	.013	90.1	
			Skin	1.20	10.30	3.10	26.5	.024	.063	88.3	
	4 lbs. lead arsenate (com. paste), self-boiled lime-sulphur (8-8-50).	June 19									
	Self-boiled lime-sulphur (8-8-50).	July 29									
23443 [6]	4 lbs. lead arsenate (powder), 96 lbs. hydrated lime.	May 30	Whole [4]	.36	3.10	1.40	12.0	.040	.155	88.3	110.9
			Pulp	.08	.70	.20	1.7	.007	.017	88.5	
			Skin	1.50	11.90	6.30	50.0	.033	.138	87.4	
	4 lbs. lead arsenate (powder), 32 lbs. sulphur (200-mesh fine), 64 lbs. hydrated lime.	June 19									
	32 lbs. sulphur (200-mesh fine), 68 lbs. hydrated lime.	July 29									
23444 [6]	8 lbs. lead arsenate, (powder), 92 lbs. hydrated lime.	May 30	Whole [4]	.67	5.60	2.00	16.8	.070	.209	88.1	104.5
			Pulp	.10	.90	.20	1.8	.008	.017	88.8	
			Skin	2.90	20.00	9.00	62.1	.062	.192	85.5	
	8 lbs. lead arsenate (powder), 32 lbs. sulphur (200-mesh fine), 60 lbs. hydrated lime.	June 19									
	64 lbs. sulphur (200-mesh fine), 36 lbs. hydrated lime.	July 29									

[3] As shucks fell.

[4] Without stones.

[5] Delaware variety, harvested Aug. 12-18, Springfield, W. Va.

[6] Elberta variety, harvested Sept. 13, Benton Harbor, Mich.

TABLE 5.—*Arsenic and lead remaining on sprayed peaches at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Arsenic.	Lead.	Loss on drying.	Average weight of peach.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.				
		1915.		*Parts per million.*				*Mg. per peach.*		*P.ct.*	*Gr.*
23445[6]	12 lbs. lead arsenate (powder), 88 lbs. hydrated lime.	May 30	Whole[4]	0.80	7.10	2.60	23.0	0.091	0.297	88.7	114.3
			Pulp	.07	.60	.20	1.8	.006	.013	89.0	
			Skin	3.50	27.80	11.60	92.1	.085	.284	87.4	
	12 lbs. lead arsenate (powder), 88 lbs. sulphur (200-mesh fine).	June 19									
	100 lbs. sulphur (200-mesh fine).	July 29									
23446[6]	2 lbs. lead arsenate (com. paste), 2 lbs. stone lime, 50 galls. water.	May 30	Whole[4]	.42	4.00	1.10	10.4	.044	.115	89.4	104.7
			Pulp	.10	1.00	.20	2.0	.008	.016	89.8	
			Skin	1.50	12.50	4.10	34.2	.036	.099	88.0	
	2 lbs. lead arsenate (com. paste), self-boiled lime-sulphur (8-8-50).	June 19									
	Self-boiled lime-sulphur (8-8-50).	July 29									
23447[6]	68 lbs. terra alba, 32 lbs. sulphur (200-mesh fine).	May 30	Whole[4]	.20	1.80	.34	3.0	.020	.034	88.8	100.5
			Pulp	.10	.90	.10	.9	.008	.010	89.1	
			Skin	.60	4.90	1.20	9.8	.012	.024	87.8	
	Do	June 19									
	Do	July 29									
23448[6]	68 lbs. hydrated lime, 32 lbs. sulphur (200-mesh fine).	May 30	Whole[4]	.24	2.30	.60	5.7	.026	.065	89.4	107.5
			Pulp	.07	.70	.20	1.9	.006	.020	89.8	
			Skin	1.10	8.70	2.50	19.7	.020	.045	87.3	
		June 19									
		July 29									
23449[6]	10 lbs. lead arsenate (powder), 90 lbs. hydrated lime.	May 30	Whole[4]	.94	8.00	2.40	20.5	.115	.295	88.3	122.8
			Pulp	.14	1.20	.20	1.7	.014	.020	88.5	
			Skin	4.50	35.40	12.20	96.1	.101	.275	87.3	
	Do	June 19									
23450[6]	Check plat (unsprayed)		Whole[4]	.23	2.00	.40	3.4	.026	.046	88.3	114.2
			Pulp	.10	.90	.14	1.2	.009	.013	88.5	
			Skin	.77	6.10	1.50	11.9	.017	.033	87.4	
		1916.									
25637[7]	Check plat (unsprayed)		Whole[4]	.04	.30	.40	2.7	.005	.052	85.1	129.4
			Pulp	.01	.10	.30	2.2	.001	.031	86.4	
			Skin	.20	1.20	.90	5.3	.004	.021	83.0	
25638[7]	Self-boiled lime-sulphur (8-8-50), 2 lbs. lead arsenate.	About May 1[3]	Whole[4]	.05	.30	.50	3.4	.005	.045	85.4	90.9
			Pulp	.01	.10	.40	2.9	.001	.028	86.2	
			Skin	.20	1.10	.90	5.2	.004	.017	82.6	
25639[7]	2 lbs. lead arsenate, 50 galls. water.	...do...	Whole[4]	.05	.30	.50	3.5	.005	.051	85.7	102.3
			Pulp	.01	.10	.30	2.1	.001	.025	85.9	
			Skin	.20	1.20	1.30	7.7	.004	.026	83.1	
	5 lbs. "soluble sulphur compd.," 3 lbs. lime, 50 galls. water, 2 lbs. lead arsenate.	3 weeks later									
	4 lbs. "soluble sulphur compd.," 4 lbs. lime, 50 galls. water.	About July 15									
25708[8]	Check plat (unsprayed)		Whole[4]	.06	.40	.40	2.7	.005	.034	85.3	85.5
			Pulp	.03	.20	.30	2.2	.002	.021	86.4	
			Skin	.20	1.20	.90	5.6	.003	.013	83.9	
25709[8]	1 lb. lead arsenate (powder), 2 lbs. stone lime, 50 galls. water.	May 29–May 30	Whole[4]	.08	.70	.40	3.7	.008	.042	89.1	105.6
			Pulp	.03	.30	.30	2.9	.002	.025	89.5	
			Skin	.30	2.20	.90	6.6	.006	.017	86.3	
	1 lb. lead arsenate (powder), self-boiled lime-sulphur (8-8-50).	June 20–June 21									
	Self-boiled lime-sulphur (8-8-50).	Aug. 1–Aug. 2									

---

[3] As shucks fell.

[4] Without stones.

[6] Elberta variety, harvested Sept. 13, Benton Harbor, Mich.

[7] Elberta variety, harvested Aug. 21, Springfield, W. Va.

[8] Elberta variety, harvested Sept. 16, Benton Harbor, Mich.

TABLE 5.—*Arsenic and lead remaining on sprayed peaches at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Arsenic.	Lead.	Loss on drying.	Average weight of peach.
		1917.		*Parts per million.*				*Mg. per peach.*		*P.ct.*	*Gr.*
27935[9]	1 lb. lead arsenate (powder), 2½ lbs. lime, 50 galls. water.	Apr. 4	Whole[4]	0.05	0.30	1.00	6.9	0.004	0.095	85.5	95.0
			Pulp	.01	.10	.40	3.0	.001	.032	86.6	
			Skin	.20	1.20	4.20	25.8	.003	.063	83.7	
	8 lbs. sulphur, 8 lbs. hydrated lime, 3 ozs. glue, 1 lb. lead arsenate (powder), 50 galls. water.	Apr. 19									
	8 lbs. sulphur, 8 lbs. hydrated lime, 3 ozs. glue, 50 galls. water.	June 7									
27936[9]	Check (unsprayed)		Whole[4]	.0	.0	.60	4.0	.0	.057	85.0	95.4
			Pulp	.0	.0	.40	2.8	.0	.032	85.7	
			Skin	.0	.0	1.70	9.8	.0	.025	82.6	
27937[9]	10 lbs. lead arsenate (powder), 90 lbs. hydrated lime.	Apr. 4	Whole[4]	.02	.10	.90	6.3	.002	.086	85.6	96.2
		Apr. 19	Pulp	.01	.10	.60	4.3	.001	.048	86.0	
			Skin	.04	.20	2.40	14.0	.001	.038	82.8	
	Pure sulphur	June 7									
27938[9]	Commercial preparation containing 50 per cent sulphur and 50 per cent lead arsenate.	Apr. 4	Whole[4]	.07	.50	1.20	8.0	.006	.110	85.0	91.5
		Apr. 19	Pulp	.0	.0	.80	5.6	.0	.062	85.6	
		June 7	Skin	.40	2.30	3.30	19.2	.006	.048	82.6	

[4] Without stones.

[9] Harvested July 9, Fort Valley, Ga.

TABLE 6.—*Arsenic, lead, and copper remaining on sprayed cherries at picking time.*

Sample No.	Spray material used.	Date sprayed.	Condition of fruit analyzed.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.
		1916.		*Parts per million.*						*P.ct.*
25452[1]	Check (unsprayed)			0.02	0.16			0.5	4.0	87.5
25453[1]	Home-made Bordeaux		Unwashed	.04	.2			2.1	11.9	82.3
			Washed[2]	.02	.1			1.4	7.9	
25454[1]	Commercial fungicide containing 12 per cent copper, 3 per cent arsenic.		Unwashed	.09	.7			2.0	15.0	86.7
			Washed[2]	.07	.5			1.2	9.0	
25481[3]	3-4-50 Bordeaux, 2 lbs. lead arsenate (paste).	May 30, June 21.	Unwashed	.15	.7	1.2	5.4	3.2	14.4	77.8
			Washed[2]	.09	.4	.7	3.2	1.8	8.1	
	3-4-50 Bordeaux	July 3.								
25482[3]	Check (unsprayed)			.08	.4	.6	2.8	1.4	6.5	78.6
25483[3]	1½ galls. lime-sulphur solution, 2 lbs. lead arsenate (paste), 50 galls. water.	May 30, June 21.	Unwashed	.15	.7	.6	2.8			78.9
			Washed[2]	.10	.5	.4	1.9			
	1½ galls. lime-sulphur solution, 50 galls. water.	July 3.								
25484[4]	Check (unsprayed)			.08	.6	.7	5.3	1.1	8.3	86.7
25485[4]	1½ galls. lime-sulphur, 2 lbs. lead arsenate (paste), 50 galls. water.	May 29-30, June 20.	Unwashed	.16	1.0	1.3	8.1			83.9
			Washed[2]	.16	1.0	1.3	8.1			
25486[4]	3-4-50 Bordeaux, 2 lbs. lead arsenate (paste).	May 29-30, June 20.	Unwashed	.35	2.3	.7	4.6	2.3	15.2	84.9
			Washed[2]	.17	1.1	.5	3.3	1.6	10.6	

[1] Picked July 12, 1916, Wenatchee, Wash.

[2] Washed by holding under running tap water for a few minutes.

[3] Sweet cherries, picked July 20, 1916, Hart, Mich.

[4] Sour cherries, picked July 20, 1916, Hart, Mich.

TABLE 7.—*Arsenic, lead, and copper remaining on sprayed plums at picking time.*

Sample No.	Spray material used.	Date sprayed.	Condition of fruit analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
		1916.		*Parts per million.*						*P. ct.*
25640[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	0.06	0.5	0.2	1.6	0.3	2.4	87.4
			Washed[2]	.06	.5	.2	1.6	.3	2.4	......
	1 lb. com. spray containing 1.7 per cent copper, 5 per cent lead arsenate, 7 per cent calcium arsenate, 2 per cent sulphur, 50 galls. water.	June 22, Aug. 1, 2.								
25641[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	.04	.3	.4	3.1	......	......	87.0
			Washed[2]	.03	.2	.2	1.5	......	......	......
	5 lbs. sulphur, 50 galls. water.	June 22, Aug. 1, 2.								
25642[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	.03	.2	.2	1.6	......	......	87.2
			Washed[2]	.03	.2	.2	1.6	......	......	......
	4 lbs. barium polysulphid, 50 galls. water.	June 22, Aug. 1, 2.								
25643[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	.04	.3	.2	1.6	......	......	87.7
			Washed[2]	.04	.3	.2	1.6	......	......	......
	1 lb. sodium polysulphid, 50 galls. water.	June 22, Aug. 1, 2.								
25644[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	.03	.2	.3	2.4	......	......	87.6
			Washed[2]	.02	.2	.2	1.6	......	......	......
	Self-boiled lime-sulphur (8-8-50).	June 22, Aug. 1, 2.								
25645[1]	2 lbs. lead arsenate (paste), 50 galls. water.	May 26.	Unwashed	.03	.3	.2	1.7	......	......	88.1
			Washed[2]	.03	.3	.2	1.7	......	......	......
	Self-boiled lime-sulphur (8-8-50), 2 lbs. soap	June 22, Aug. 1, 2.								
25646[1]	Check (unsprayed)	....	Unwashed	.03	.2	.3	2.2	0.5	3.7	86.6
			Washed[2]	.02	.1	.2	1.4	.4	3.0	......
25807[3]	2 lbs. lead arsenate (paste), plus lime, 50 galls. water.	May 27.	Unwashed	.13	.8	.5	2.9	......	......	82.9
			Washed[2]	.07	.4	.5	2.9	......	......	......
	1½ galls. lime-sulphur solution, 50 galls. water. 2 lbs. lead arsenate (paste).	June 21, 22, 23								
	1½ galls. lime-sulphur solution, 50 galls. water.	Aug. 12.								
25808[3]	2 lbs. lead arsenate (paste), 50 galls. water, plus lime.	May 27.	Unwashed	.07	.4	.3	1.7	......	......	81.8
			Washed[2]	.07	.4	.3	1.7	......	......	......
	Self-boiled lime-sulphur (8-8-50), 2 lbs. lead arsenate (paste), 50 galls. water.	June 21, 22, 23								
	Self-boiled lime-sulphur (8-8-50).	Aug. 12.								
25809[3]	2 lbs. lead arsenate (paste), plus lime, 50 galls. water.	May 27.	Unwashed	.13	.7	.4	2.3	1.2	6.8	82.3
			Washed[2]	.10	.6	14	2.3	.9	5.1	......
	Bordeaux 3-4-50, 2 lbs. lead arsenate (paste).	June 21, 22, 23								
	Bordeaux 3-4-50	Aug. 12.								
25810[3]	Check (unsprayed)	....	Unwashed	.10	.6	.4	2.3	.6	3.4	82.3
			Washed[2]	.07	.4	.3	1.7	.6	3.4	......

---

[1] Burbank; picked last of August, Hart, Mich.

[2] Washed by holding under running tap water for a few minutes.

[3] Golden Domestica; picked last of September, Hart, Mich.

TABLE 8.—*Arsenic, lead, and copper remaining on sprayed tomatoes at picking time.*

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.
		1915.		*Parts per million.*						*P. ct.*
23304[1]	Check (unsprayed)	......	Whole fruit	......	......	......	......	1.8	30.0	94.0
			Pulp	......	......	......	......	1.2	20.0	94.0
23305[1]	8-9-50 Bordeaux mixture.	July 8, 19, 21, 31, Aug. 5, 11, 18, Sept. 11.	Whole fruit	......	......	......	......	5.7	91.9	93.8
			Pulp	......	......	......	......	2.2	35.5	93.8
23306[1]	5-6-50 Bordeaux	July 8, 19, 20, 31, Aug. 5, 10, 18, Sept. 4, 11.	Whole fruit	......	......	......	......	5.7	91.9	93.8
			Pulp	......	......	......	......	1.6	25.8	93.8
		1916.								
25664[2]	Check (unsprayed)	......	Whole fruit	0.02	0.4	0.9	16.1	.6	10.7	94.4
			Pulp	.02	.4	.6	10.7	.5	8.9	94.4
25665[2]	5-5-50 Bordeaux, 1½ lbs. lead arsenate (powder).	July 13, Aug. 7, 25, Sept. 8.	Whole fruit	.3	5.2	1.7	29.8	1.0	17.5	94.3
			Pulp	.05	.9	1.2	21.1	.6	10.5	94.3
25825[3]	Check (unsprayed)	......	Whole fruit	.07	1.4	.3	6.0	.7	14.0	95.0
			Pulp	.02	.4	.2	4.0	.7	14.0	95.0
25826[3]	5-5-50 Bordeaux, 1½ lbs. lead arsenate (powder). 5-5-50 Bordeaux	July 13, Aug. 7, 25, Sept. 8. Sept. 18.	Whole fruit	.07	1.1	.5	7.6	4.0	60.6	93.4
			Pulp	.02	.3	.2	3.3	.9	13.6	93.4
25706[4]	4-4-50 Bordeaux	......	Whole fruit	......	......	......	......	.9	17.0	94.7
			Pulp	......	......	......	......	.5	9.4	94.7
25707[4]	Check (unsprayed)	......	Whole fruit	......	......	......	......	.6	10.5	94.3
			Pulp	......	......	......	......	.5	8.8	94.3
25710[4]	Check (unsprayed)	......	Whole fruit	......	......	......	......	.7	13.2	94.7
			Pulp	......	......	......	......	.7	13.2	94.7
25711[4]	4-4-50 Bordeaux	......	Whole fruit	......	......	......	......	.8	14.3	94.4
			Pulp	......	......	......	......	.7	12.5	94.4

[1] Fruit picked Sept. 15, 1915, Camden, N. J.
[2] Fruit picked Sept. 14, 1916, Arlington, Va.
[3] Fruit picked Oct. 2, 1916, Arlington, Va.
[4] Fruit picked Sept. 15, 1916, Salem, N. J.; samples represent commercial fruit ready for market.

TABLE 9.—*Copper remaining on sprayed celery at gathering time.*[1]

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Copper (Cu). Original celery.	Copper (Cu). Dried celery.	Loss on drying.
		1915.		*Parts per million.*		*Per cent.*
23585[2]	Check plat (unsprayed)	......	Unwashed (check)	2.3	24.2	90.5
23586[2]	Oversprayed with 5-5-50 Bordeaux mixture, 2 lbs. resin fish-oil soap.	Aug. 14, 24, Sept. 2, 14.	Unwashed leaves[3]	258.1	2,150.8	88.0
			Unwashed stalks[3]	16.6	207.5	92.0
			Washed leaves[4]	65.7	547.5	88.0
			Washed stalks[4]	8.2	102.5	92.0
23587[2]	5-5-50 Bordeaux mixture, 2 lbs. resin fish-oil soap.	Aug. 14, 24, Sept. 2, 14.	Unwashed leaves[3]	213.0	1,775.0	88.0
			Unwashed stalks[3]	3.6	45.0	92.0
			Washed leaves[4]	85.5	712.5	88.0
			Washed stalks[4]	2.9	36.3	92.0
		1917.				
28783[5]	Commercially sprayed with 5-5-50 Bordeaux plus soap.	Sept. 11, 22, Oct. 1.	Unwashed leaves	4.7	33.6	86.0
			Unwashed stalks	.9	11.5	92.2
			Washed leaves[6]	2.9	20.7	......
			Washed stalks[6]	.9	11.5	......
28784[5]	Oversprayed with 5-5-50 Bordeaux plus soap.	Sept. 11, 22, Oct. 1.	Unwashed leaves	12.8	91.4	86.0
			Unwashed stalks	1.6	20.0	92.0
			Washed leaves[6]	2.1	15.0	......
			Washed stalks[6]	.7	8.7	......

[1] The samples sprayed in 1915 were coated with copper spray when received and represent extremely heavy applications; the 1917 samples represent celery as it usually appears on the market.
[2] Harvested Oct. 29, 1915, North Liberty, Ind.
[3] These sprayed samples were heavily coated with the spray material when received.
[4] Washing done by holding sample under faucet water for few minutes.
[5] Harvested about Nov. 1, 1917, North Liberty, Ind.
[6] Washed by soaking celery in water for a short time and then rubbing with a small brush.

TABLE 10.—*Copper remaining on sprayed cucumbers at picking time.*

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.
				Parts per million.		*Per cent.*
25660 [1]	Check (unsprayed)	1916	Whole fruit	0.6	11.3	94.7
			Pulp	.3	7.1	95.8
			Skin	.5	7.7	93.5
25661 [1]	2-4-50 Bordeaux	1916	Whole fruit	1.2	25.5	95.3
			Pulp	.3	7.3	95.9
			Skin	2.8	44.4	93.7
25662 [1]	2-4-50 Bordeaux plus 2 lbs. resin fish-oil soap.	1916	Whole fruit	1.2	25.5	95.3
			Pulp	.3	7.3	95.9
			Skin	2.5	39.1	93.6
25663 [1]	5-5-50 Bordeaux	1916	Whole fruit	1.4	28.6	95.1
			Pulp	.3	6.8	95.6
			Skin	2.5	38.5	93.5

[1] Cucumbers picked Sept. 9, 1916, Plymouth, Ind.

TABLE 11.—*Arsenic, lead, and copper remaining on sprayed cranberries at picking time.*

Sample No.	Spray material used.	Date sprayed.	Condition of fruit analyzed.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.
				Parts per million.						*P. ct.*
23453 [1]	Sprayed lightly with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap.[2]	1915. June 24, July 26, Aug. 11, 28.	Unwashed	......	......	......	......	7.4	62.7	88.2
			Washed [3]	......	......	......	......	7.1	60.2	88.2
23454 [1]	Sprayed medium with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap (normal spray for region).[2]	do	Unwashed	......	......	......	......	3.9	33.9	88.5
			Washed [3]	......	......	......	......	2.3	20.0	88.5
23455 [1]	Sprayed heavily with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap.[2]	do	Unwashed	......	......	......	......	7.6	66.1	88.5
			Washed [3]	......	......	......	......	4.8	41.7	88.5
23456 [1]	Oversprayed with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap.[2]	June 10, July 10, 31, Aug. 16.	Unwashed	......	......	......	......	33.3	268.5	87.6
			Washed [3]	......	......	......	......	16.2	130.6	87.6
23684 [4]	Sprayed heavily with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap.[5]	June 19, July 27, Aug. 12.	Unwashed	......	......	......	......	2.0	15.0	86.7
			Washed [3]	......	......	......	......	1.7	12.8	86.7
23685 [4]	Sprayed medium with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap (normal spray for region).[5]	do	Unwashed	......	......	......	......	2.0	14.4	86.1
			Washed [3]	......	......	......	......	1.8	12.9	86.1
23686 [4]	Sprayed lightly with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap.[5]	do	Unwashed	......	......	......	......	2.6	17.9	85.5
			Washed [3]	......	......	......	......	2.4	16.5	85.5
23687 [4]	Check (unsprayed) [5]			......	......	......	......	.9	7.1	87.4
25727 [1]	Commercially sprayed with 3-3-50 Bordeaux, 2 lbs. resin fish-oil soap.[6]	1916. June 26, July 27, Aug. 5, 25.	Unwashed	......	......	......	......	7.2	62.1	88.4
			Washed [7]	......	......	......	......	3.0	25.9	88.4

[1] Early Black.

[2] Harvested Sept. 18, 1915, Brown Mills, N. J.

[3] Washed by holding the berries in running tap water.

[4] Howe.

[5] Harvested Oct. 16, 1915, Brown Mills, N. J.

[6] Harvested Sept. 18, 1916, Brown Mills, N. J.

[7] Washed by soaking berries in water for a short time, pouring off the water, adding more water, and repeating operation three times.

TABLE 11.—*Arsenic, lead, and copper remaining on sprayed cranberries at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Condition of fruit analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
				Parts per million.						*P. ct.*
26166	Sprayed lightly with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap, 2 lbs. lead arsenate (powder).[8]	1916. Aug. 1, 24.	Unwashed	1.2	8.7	4.8	34.8	5.5	39.8	86.2
			Washed [7]	.8	5.8	2.5	18.1	2.3	16.7	86.2
26167	Sprayed normally with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap, 2 lbs. lead arsenate (powder).[8]	do	Unwashed	1.3	9.4	5.7	41.3	6.7	48.6	86.2
			Washed [7]	1.0	7.2	2.5	18.1	3.1	22.5	86.2
26168	Sprayed heavily with 4-4-50 Bordeaux, 2 lbs. resin fish-oil soap, 2 lbs. lead arsenate (powder).[8]	do	Unwashed	1.7	12.8	7.4	55.6	10.0	75.2	86.7
			Washed [7]	1.0	7.5	3.8	28.6	4.6	34.6	86.7
26169	Oversprayed with 4-4-50 Bordeaux, 2 lbs. arsenate (powder), 2 lbs. resin fish-oil soap.[8]	Aug. 2, 24.	Unwashed	2.5	19.1	9.2	70.2	11.4	87.0	89.9
			Washed [7]	1.0	7.6	4.4	33.6	3.7	28.2	86.6
26170	Check (unsprayed).[8]		Unwashed	.1	.7	.6	4.4	1.0	7.4	86.5
			Washed [7]	.1	.7	.6	4.4	1.0	7.4	86.5
27337 [1]	4-5-50 Bordeaux, 2 lbs. resin fish-oil soap.[9]	June 24, Aug. 3.	Unwashed					2.2	17.2	87.2
			Washed [7]					1.0	7.8	
27338[10]	10 lbs. lead arsenate (paste), 50 galls. water.[11]	July 22.	Unwashed	.14	1.1	1.5	11.6			87.1
			Washed [7]	.14	1.1	.9	7.0			
27339[10]	10 lbs. lead arsenate (paste), 2 lbs. laundry soap, 50 galls. water.[11]	July 22, 24.	Unwashed	.16	1.2	1.1	8.1			86.5
			Washed [7]	.16	1.2	1.1	8.1			
27340 [1]	5 lbs. lead arsenate (powder), 50 galls. water.[11]	June 28, Aug. 1.	Unwashed	3.9	30.7	19.1	150.4			87.3
			Washed [7]	1.5	11.8	11.5	90.6			
	3 lbs. lead arsenate (powder), 50 galls. water.[12]	Aug. 19.								
27346 [1]	4-5-50 Bordeaux, 2 lbs. resin fish-oil soap.[9]	June 24, Aug. 3.	Unwashed					3.0	23.4	87.2
			Washed [7]					1.6	12.5	
27347[10]	10 lbs. lead arsenate (paste), 50 galls. water.[11]	July 222	Unwashed	.14	1.1	1.4	10.5			86.7
			Washed [7]	.14	1.1	1.1	8.3			
27348[10]	10 lbs. lead arsenate (paste), 2 lbs. laundry soap, 50 galls. water.[11]	July 22, 24.	Unwashed	.15	1.2	1.5	11.7			87.2
			Washed [7]	.09	.7	1.0	7.8			
27349 [1]	5 lbs. lead arsenate (powder), 50 galls. water.	June 28, Aug. 1.	Unwashed	3.9	30.7	18.9	148.8			87.3
			Washed [7]	1.4	11.0	12.4	97.7			
	3 lbs. lead arsenate (powder), 50 galls. water.[12]	Aug. 19.								
27181	Check (unsprayed)[11]		Unwashed	.02	.14	.4	2.9	0.9	6.4	86.0
			Washed [7]	.02	.14	.4	2.9	.7	5.0	
28686	4 lbs. lead arsenate (powder), 50 galls. water, 2 lbs. caustic potash fish-oil soap.[13]	1917. June 26, July 26, 30.	Unwashed	1.1	9.6	4.5	39.5			88.6
			Washed [7]	.6	5.3	2.9	25.4			
28685	Check (unsprayed)[13]		Unwashed	.01	.08	.7	5.6	0.6	4.8	87.6
			Washed [7]	.01	.08	.7	5.6	.6	4.8	
28556	3 lbs. lime, 4 lbs. copper sulphate, 2 lbs. resin fish-oil soap, 50 galls. water.[13]	June 28, Aug. 4, 20.	Unwashed	.1	.8	.6	4.9	1.3	10.6	87.8
			Washed [7]	.1	.8	.6	4.9	1.2	9.8	
28830	4 lbs. lead arsenate (powder), 2 lbs. caustic potash fish-oil soap, 50 galls. water.[13]	June 26, July 26, 30.	Unwashed	1.2	10.0	4.8	40.0			88.[illegible]
			Washed [7]	.3	2.5	1.9	15.8			

---

[1] Early Black.

[7] Washed by soaking berries in water for a short time, pouring off the water, adding more water, and repeating operation three times.

[8] Harvested Oct. 9, 1916, Brown Mills, N. J.

[9] Harvested Sept. 23, 1916, East Wareham, Mass.

[10] Late Home.

[11] Harvested Oct. 2, 1916, East Wareham, Mass.

[12] Harvested Sept. 25, 1916, East Wareham, Mass.

[13] Harvested Oct., 1917, East Wareham, Mass.

Some of the samples from New Jersey reported in Table 11 represent plots which were purposely oversprayed and contain relatively large amounts of spray residues. The lots sprayed according to recommended schedule contain much less spray residue. Samples 27340 and 27349 show a comparatively large amount of spray residue, but these samples are from experimental plots which were sprayed late. The other Massachusetts samples show very little spray residue. The results indicate that when sprayed with the regulation spray and washed before using the berries contain but little spray material.

TABLE 12.—*Copper, lead, and arsenic remaining on sprayed grapes at picking time.*

Sample No.	Spray material used.	Date sprayed.	Condition of samples analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
		1915.		*Parts per million.*						*P. ct.*
23565[1]	2½ lbs. lead arsenate (powder), 4-4-50 Bordeaux.[2]	June 4, July 16.	Unwashed	0.25	1.50	2.6	15.1	0.8	4.7	82.8
			Washed[3]	.14	.80	2.4	14.0	.6	3.4	......
23566[1]	1 lb. lead arsenate (powder), 4-4-50 Bordeaux.[2]	.....do......	Unwashed	.13	.80	2.1	13.1	.7	4.4	84.0
			Washed[3]	.13	.80	1.3	8.1	.6	3.8	......
23567[1]	Check plat (unsprayed)[2]	....	....	.07	.40	1.1	6.8	.4	2.5	83.9
23571[1]	Check plat (unsprayed)[4]	....	....	.07	.40	.6	3.2	.4	2.1	81.0
23572[1]	3 lbs. lead arsenate (paste), 2 lbs. fish-oil soap, 3-3-50 Bordeaux (sprayed with coarse nozzle).	July 6.	Unwashed	.44	2.70	1.4	8.4	1.3	7.8	83.4
			Washed[3]	.30	1.80	1.2	7.2	1.1	6.6	......
	3 lbs. lead arsenate (paste), 1 lb. laundry soap, 3-3-50 Bordeaux (sprayed with coarse nozzle).[4]	July 19.								
23573[1]	5 lbs. lead arsenate (paste), 2 lbs. fish-oil soap, 3-3-50 Bordeaux (sprayed with coarse nozzle).	July 6.	Unwashed	.80	4.80	2.4	14.4	1.5	9.0	83.3
			Washed[3]	.35	2.10	1.3	7.8	1.1	6.6	......
	5 lbs. lead arsenate (paste), 1 lb. laundry soap, 3-3-50 Bordeaux (sprayed with coarse nozzle).[4]	July 19.								
23574[1]	5 lbs. lead arsenate (paste), 2 lbs. fish-oil soap, 3-3-50 Bordeaux (oversprayed, coarse nozzle).	July 6.	Unwashed	.80	4.70	8.2	48.5	1.8	10.7	83.1
			Washed[3]	.35	2.10	2.4	14.2	1.4	8.3	......
	5 lbs. lead arsenate (paste), 1 lb. laundry soap, 3-3-50 Bordeaux (oversprayed, coarse nozzle).[4]	July 19.								
23688[1]	3 lbs. lead arsenate (paste), 3-3-50 Bordeaux (sprayed with trailers, using fine nozzles).[5]	July 5, 17.	Unwashed	.40	1.90	1.5	7.1	1.2	5.7	79.0
			Washed[3]	.40	1.90	1.2	5.7	.7	3.3	......
23689[1]	3 lbs. lead arsenate (paste), 1 lb. laundry soap, 3-3-50 Bordeaux (sprayed with trailers, using fine nozzles) (normal schedule for this region).[5]	.....do......	Unwashed	.82	3.90	2.4	11.5	1.8	8.7	79.2
			Washed[3]	.50	2.40	1.4	6.7	1.2	5.8	......

[1] Concord.
[2] Harvested Oct. 9, 1915, Benton Harbor, Mich.
[3] Samples washed in running tap water.
[4] Harvested Oct. 9, 1915, North East, Pa.
[5] Harvested Oct. 27, 1915, North East, Pa.

TABLE 12.—*Copper, lead, and arsenic remaining on sprayed grapes at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Condition of samples analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
		1915.				*Parts per million.*				*P. ct.*
23690[1]	3 lbs. lead arsenate (paste), 1 lb. laundry soap, 3-3-50 Bordeaux (spray applied with fine nozzles set at rear of sprayer).[5]	July 5, 17.	Unwashed.	0.29	1.40	0.9	4.3	0.6	2.9	79.0
			Washed[3]	.22	1.00	.4	1.9	.3	1.4	......
25836[1]	Check plat (unsprayed)[6]	....	Unwashed.	.0	.0	.5	2.6	.9	4.7	81.0
			Washed[3]	.0	.0	.5	2.6	.6	3.2	......
		1916.								
25837[1]	1 gall. lime-sulphur, 33° B.), 7 galls. water. 4-4-50 Bordeaux[6]	Dormant spray. June 16.	Unwashed.	.05	.26	.7	3.6	1.1	5.6	80.4
			Washed[3]	.02	.10	.6	3.1	1.1	5.6	......
25838[1]	8 lbs. Bordeaux (com. paste), 1 lb. lead arsenate (powder), 50 galls. water. 8 lbs. Bordeaux (com. paste), 50 galls. water.[6]	June 1, 12. Aug. 2.	Unwashed.	.12	.63	.8	4.2	1.4	7.4	81.1
			Washed[3]	.07	.37	.6	3.2	1.1	5.8	......
25903[1]	Check plat (unsprayed)[7]	....	Unwashed.	.04	.17	.6	2.6	.8	3.4	76.5
			Washed[3]	.04	.17	.6	2.6	.4	1.7	......
25904[1]	1 lb. soap, 1½ lbs. lead arsenate (powder), 3-3-50 Bordeaux (used trailers with medium nozzles).[7]	July 6, 21.	Unwashed.	3.00	12.60	7.5	31.6	4.1	17.3	76.3
			Washed[3]	1.00	4.20	3.5	14.8	1.4	5.9	......
25905[1]	1 lb. soap, 2½ lbs. lead arsenate (powder), 3-3-50 Bordeaux (used trailers with medium nozzles).[7]	.....do......	Unwashed.	.70	3.20	3.9	17.7	2.1	9.5	78.0
			Washed[3]	.60	2.70	2.8	12.7	1.3	5.5	......
25906[1]	1 lb. soap, 2½ lbs. lead arsenate (powder), 3-3-50 Bordeaux (used trailers with medium nozzles). 1 lb. lime, 1 lb. soap, 2½ lbs. lead arsenate (powder), 50 galls. water (double application).[7]	.....do...... Aug. 12.	Unwashed.	3.80	16.10	12.0	50.8	3.2	13.6	76.4
			Washed[3]	2.60	11.00	7.6	32.2	1.7	7.2	......
25907[1]	1 lb. soap, 1½ lbs. lead arsenate (powder), 3-3-50 Bordeaux (used trailers with fine nozzle).[7]	July 6, 21.	Unwashed.	.30	1.30	2.4	10.3	2.3	9.8	76.6
			Washed[3]	.30	1.30	1.3	5.6	1.5	6.5	......
26016[8]	4-3-50 Bordeaux (medium set nozzle).[9]	June 15.	Unwashed.	.15	.60	.7	2.9	2.0	8.3	75.8
			Washed[3]	.15	.60	.7	2.9	1.3	5.4	......
26017[8]	4-3-50 Bordeaux (medium set nozzle). 2½ lbs. lead arsenate (powder), 2 lbs. laundry soap, 3-3-50 Bordeaux (sprayed with trailer, fine nozzle). 2½ lbs. lead arsenate (powder), 1 lb. resin soap, 3-3-50 Bordeaux (sprayed with trailer, fine nozzle).[9]	.....do...... June 28. Aug. 4.	Unwashed.	1.80	7.30	5.1	20.7	2.7	11.0	75.4
			Washed[3]	.70	2.80	2.1	8.5	1.5	6.1	......
26018[8]	4-3-50 Bordeaux (medium set nozzle). 2½ lbs. lead arsenate (powder), 2 lbs. laundry soap, 3-3-50 Bordeaux (sprayed with trailer, coarse nozzle). 2½ lbs. lead arsenate (powder), 1 lb. resin soap, 3-3-50 Bordeaux (sprayed with trailer, coarse nozzle)[9].	June 15. June 28. Aug. 4.	Unwashed.	3.70	16.30	10.4	45.8	3.4	15.0	77.3
			Washed[3]	.90	4.00	3.1	13.7	1.4	6.2	......

[1] Concord.

[3] Samples washed in running tap water.

[5] Harvested Oct. 27, 1915, North East, Pa.

[6] Harvested Sept. 30, 1916, Benton Harbor, Mich.

[7] Harvested Oct. 6, 1916, North East, Pa.

[8] Catawba.

[9] Harvested Oct. 13, 1916, Sandusky, Ohio.

TABLE 12.—*Copper, lead, and arsenic remaining on sprayed grapes at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Condition of samples analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
		1916.		*Parts per million.*						*P. ct.*
26019 [8]	4-3-50 Bordeaux (sprayed with medium set nozzle).	June 15.	Unwashed.	4.00	16.30	12.6	51.3	4.4	18.0	75.4
			Washed [3]	1.00	4.10	4.9	19.9	2.0	8.1	......
	2½ lbs. lead arsenate (powder), 2 lbs. laundry soap, 3-3-50 Bordeaux (oversprayed with trailer, coarse nozzle).	June 28.								
	2½ lbs. lead arsenate (powder), 1 lb. resin soap, 3-3-50 Bordeaux (oversprayed with trailer, coarse nozzle).[9]	Aug. 4.								
26020 [8]	4-3-50 Bordeaux (sprayed with medium set nozzle).	June 15.	Unwashed.	2.80	12.70	6.2	28.2	3.1	14.1	78.0
			Washed [3]	1.00	4.50	3.2	14.6	1.7	7.7	......
	2½ lbs. lead arsenate (powder), 2 lbs. laundry soap, 3-3-50 Bordeaux (sprayed with trailer, medium nozzle).[9]	June 28, July 12.								
26021 [8]	4-3-50 Bordeaux (sprayed with medium set nozzle).	June 15.	Unwashed.	4.60	21.10	13.3	61.0	4.6	21.1	78.2
			Washed [3]	2.70	12.40	6.4	29.4	1.8	8.3	......
	2½ lbs. lead arsenate (powder), 2 lbs. laundry soap, 3-3-50 Bordeaux (sprayed with trailer, medium nozzle).	June 28, July 12.								
	2½ lbs. lead arsenate (powder), 1 lb. resin soap, 2-3-50 Bordeaux.[9]	Aug. 2.								
		1917.								
28881 [8]	3-3-50 Bordeaux (set nozzle).	June 18.	Unwashed.	3.20	16.00	8.1	40.5	2.7	13.5	80.0
			Washed [10]	1.30	6.50	3.7	18.5	2.0	10.0	......
	1½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (trailer, medium nozzle) (schedule recommended for this region).[11]	July 2-4, 24-25.								
28882 [8]	3-3-50 Bordeaux (set nozzle).	June 18-20.	Unwashed.	7.10	35.50	17.6	88.0	4.2	21.0	80.0
			Washed [10]	3.60	18.00	11.3	56.5	2.6	13.0	......
	1½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (trailer, medium nozzle).[11]	July 2-4, 24-25, Aug. 14.								
28883 [8]	3-3-50 Bordeaux (set nozzle).	June 18-20.	Unwashed.	6.20	30.10	15.5	75.2	3.7	18.0	79.4
			Washed [10]	3.30	16.00	8.6	41.7	2.8	13.6	......
	1½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (sprayed with trailer, medium nozzle).	July 2-4.								
	2½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (sprayed with trailer, medium nozzle).[11]	July 24-25.								

[3] Samples washed in running tap water.

[8] Catawba.

[9] Harvested Oct. 13, 1916, Sandusky, Ohio.

[10] Samples washed by soaking the grapes in water for 5 minutes, pouring off the water, and then washing in running tap water.

[11] Harvested Oct. 27, 1917, Sandusky, Ohio.

TABLE 12.—*Copper, lead, and arsenic remaining on sprayed grapes at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Condition of samples analyzed.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	
		1917.		*Parts per million.*						*P. ct.*
28884[12]	3-3-50 Bordeaux (sprayed with set nozzle).	June 18-20.	Unwashed	5.70	31.10	13.0	71.0	4.3	23.5	81.7
			Washed[10]	4.40	24.00	12.0	65.6	3.3	18.0	......
	2½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux, (sprayed with trailer, medium nozzle).[13]	July 2-4, 24-25.								
28886[8]	3-3-50 Bordeaux (sprayed with set nozzle).	June 18-20.	Unwashed	5.90	30.30	14.8	75.9	2.3	11.8	80.5
			Washed[10]	1.30	6.70	3.9	20.0	1.7	8.7	......
	1½ lbs. lead arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (sprayed with trailer, medium nozzle).[11]	July 2-4, Aug. 14.								
28887[12]	3-3-50 Bordeaux (sprayed with set nozzle).	June 18.	Unwashed	4.60	24.30	......	......	6.4	33.8	81.1
			Washed[10]	1.80	9.50	......	......	4.2	22.2	......
	1 lb. calcium arsenate (powder), 1 lb. resin fish-oil soap, 2-3-50 Bordeaux (sprayed with trailer, medium nozzle).[13]	July 2-4, 24-25.								
28888[8]	3-3-50 Bordeaux (sprayed with set nozzle).[11]	June 18-20.	Unwashed	.08	.40	.9	4.5	1.5	7.6	80.2
			Washed[10]	.08	.40	.9	4.5	1.3	6.6	......
28889[12]	3-3-50 Bordeaux (sprayed with set nozzle).[13]	June 18-20.	Unwashed	.08	.40	.5	2.5	1.5	7.6	80.2
			Washed[10]	.08	.40	.3	1.5	1.5	7.6	......

[8] Catawba.

[10] Samples washed by soaking the grapes in water for 5 minutes, pouring off the water, and then washing in running tap water.

[11] Harvested Oct. 27, 1917, Sandusky, Ohio.

[12] Ives.

[13] Harvested Oct. 18, 1917, Sandusky, Ohio.

WEATHER CONDITIONS.

Nos. 23565-67: Ideal for spraying during both applications; all foliage and fruit were covered.

Nos. 23571-74 and 23688-90: Heavy rain on July 8, which seemed to wash off a large amount of the spray material.

Nos. 25836-38 and 25903-07: No abnormal weather conditions reported.

Nos. 26016-21: Dry, hot, clear; season unusually dry.

Nos. 28881-89: Rainfall normal; in no case did rain interfere with the spraying, nor did rain fall before material was well dried.

The Michigan samples and the Pennsylvania samples mentioned in Table 12 that were sprayed according to normal schedule showed very little spray residue at harvest. Grapes sprayed in Sandusky, Ohio, according to the schedule formerly used in that region showed a decided spray residue on their surface at harvest. As this spray residue was no doubt due mainly to late spraying, the Bureau of Entomology has recommended a new schedule which is given under Sample 28881. Table 12 shows the composition of grapes sprayed according to the recommended schedule as compared with that of those sprayed under the schedule formerly used, as well as the composition of grapes sprayed under various experimental schedules.

TABLE 13.—*Arsenic, lead, and copper remaining on sprayed pears at picking time.*

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in pear (average).	Lead in pear (average).	Copper in pear (average).	Average weight, pear.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
				Parts per million.						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
23282[1]	1 gall. lime-sulphur, 40 galls. water (normal schedule).	1915. May 15.	Whole	0.32	2.1	1.0	6.7	1.5	10.0	85.0	0.049	0.151	0.227	151.6
			Pulp	.08	.6	.2	1.4	.7	4.9	85.8	.010	.025	.095	
	1 gall. lime-sulphur, 2½ lbs. lead arsenate (paste), 50 galls. water (normal schedule).	May 26.	Skin	1.00	4.3	3.2	13.7	4.5	19.3	76.7	.023	.073	.102	
			Calyx	6.40	27.7	21.3	92.2	12.1	52.4	76.9	.016	.053	.030	
	4-4-50 Bordeaux, 2½ lbs. lead arsenate (paste)[3] (normal schedule).	June 16.	Skin[2]	.47	2.0	2.4	10.3	2.1	9.0	76.7	.011	.054	.049	
			Calyx[2]	6.40	27.7	21.3	92.2	7.8	33.8	76.9	.016	.053	.020	
23281[1]	Check plat (unsprayed)[3]		Whole	.06	.3	.20	1.0	.8	4.0	80.1	.008	.027	.110	132.8
23568[4]	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur, 50 galls. water.	May 12.	do	.30	2.0	.9	6.1			85.2	.026	.077		89.2
			Pulp	.10	.8	.2	1.7			88.0	.007	.015		
	1 lb. lead arsenate (powder), 1¼ galls. lime-sulphur, 50 galls. water.[5]	June 15-16.	Skin	.90	4.0	3.0	13.4			77.6	.014	.045		
			Calyx	5.10	23.4	17.2	78.9			78.2	.005	.017		
			Skin[2]	.90	4.0	3.0	13.4			77.6	.014	.045		
			Calyx[2]	5.10	23.4	17.2	78.9			78.2	.005	.017		
23569[4]	¾ lb. calcium arsenate (powder), 1½ galls. lime-sulphur, 50 galls. water.	May 13.	Whole	.22	1.3					83.5	.017			77.4
			Pulp	.05	.4					88.4	.003			
	¾ lb. calcium arsenate (powder), 1¼ galls. lime-sulphur, 2 lbs. freshly-slaked stone lime, 50 galls. water.[5]	June 16.	Skin	.60	2.9					79.3	.009			
			Calyx	6.00	27.1					77.9	.005			
			Skin[2]	.60	2.9					79.3	.009			
			Calyx[2]	6.00	27.1					77.9	.005			
23596	Check plat (unsprayed)[5]		Whole	.08	.4	0.2	1.1	0.3	1.7	82.2	.009	0.022	0.033	111.2
25919[6]	Check plat (unsprayed)[7]		do	.10	.6	.2	1.3			84.2	.013	.026		128.0
25920[8]	Check plat (unsprayed)[7]		do	.05	.3	.3	1.5	.9	4.5	80.1	.006	.037	.113	125.0

[1] Bartlett.
[2] Fruit wiped with dry cloth before peeling.
[3] Harvested Sept. 1, 1915, Benton Harbor, Mich.
[4] Kieffer.
[5] Harvested Oct. 9, 1915, Benton Harbor, Mich.
[6] Clarigeau.
[7] Harvested Sept. 30, 1916, Benton Harbor, Mich.
[8] Anjou.

TABLE 13.—*Arsenic, lead, and copper remaining on sprayed pears at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in pear (average).	Lead in pear (average).	Copper in pear (average).	Average weight, pear.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1916.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
25924 [8]	1½ galls. lime-sulphur (32° B.), 50 galls. water.	May 14.	Whole	0.10	0.5	0.3	1.6	......	......	81.3	0.013	0.039	......	130.0
			Pulp	.05	.3	.2	1.3	......	......	84.4	.006	.022	......	
	1½ galls. lime-sulphur, 2½ lbs. lead arsenate (paste), 50 galls. water.[9]	May 24, June 13.	Skin	.30	1.2	.8	3.1	......	......	74.4	.005	.012	......	
			Calyx	1.20	4.8	4.2	16.7	......	......	74.8	.002	.005	......	
			Skin [10]	.30	1.2	.8	3.1	......	......	74.4	.005	.012	......	
			Calyx [10]	1.20	4.8	4.2	16.7	......	......	74.8	.002	.005	......	
25925 [8]	1 gall. lime-sulphur, 9 galls. water	Apr. 19.	Whole	.10	.5	.4	1.9	3.0	14.5	79.3	.014	.055	0.411	137.0
	1¼ galls. lime-sulphur, 50 galls. water	May 3.	Pulp	.04	.2	.2	1.0	1.0	5.1	80.3	.005	.024	.120	
	1 gall. lime-sulphur, 2 lbs. lead arsenate (paste), 50 galls. water.	May 24.	Skin	.40	1.3	1.5	5.0	16.2	54.5	70.3	.006	.024	.261	
			Calyx	1.80	5.7	5.5	17.3	21.9	68.9	68.2	.003	.007	.030	
	3 qts. lime-sulphur, 2 lbs. lead arsenate (paste), 50 galls. water.	June 13.	Skin [10]	.40	1.3	1.5	5.0	12.4	41.8	70.3	.006	.024	.200	
			Calyx [10]	1.80	5.7	5.5	17.3	8.2	25.8	68.2	.003	.007	.011	
	3-3-50 Bordeaux [9]	Aug. 16.												
25926 [6]	1¼ galls. lime-sulphur (32° B.), 4 lbs. stone lime, 1 lb. lead arsenate (powder), 50 galls. water.[9]	May 16, 26, June 22.	Whole	.10	.5	.4	1.9	......	......	78.8	.016	.066	......	164.0
			Pulp	.02	.1	.2	1.0	......	......	80.2	.003	.029	......	
			Skin	.40	1.2	1.2	3.5	......	......	66.0	.007	.021	......	
			Calyx	4.40	12.6	11.9	34.2	......	......	65.2	.006	.016	......	
			Skin [10]	.40	1.2	1.2	3.5	......	......	66.0	.007	.021	......	
			Calyx [10]	4.40	12.6	11.9	34.2	......	......	65.2	.006	.016	......	

[6] Clarigeau.

[8] Anjou.

[9] Harvested Oct. 7, 1916, Benton Harbor, Mich.

[10] Fruit wiped with damp cloth.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time.*

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1915.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
23708 [1]	Check plat (unsprayed) [2]		Whole	0.09	0.7	0.2	1.5	0.3	2.3	86.9	0.007	0.019	0.024	80.9
23709 [1]	1½ galls. lime-sulphur solution, 1 lb. lead arsenate (powder), 50 galls. water.[2]	Apr. 26, May 16, 27, June 16.	do	.10	.7	.3	2.2			86.2	.012	.036		121.7
			Pulp	.06	.5	.2	1.6			87.8	.006	.020		
			Skin	.30	1.7	.8	4.6			82.6	.004	.010		
			Calyx	1.30	8.3	3.5	22.4			84.4	.001	.003		
			Stem ends	.90	6.5	2.9	21.0			86.2	.001	.003		
			Skin [3]	.30	1.7	.8	4.6			82.6	.004	.010		
			Calyx [3]	1.30	8.3	3.5	22.4			84.4	.001	.003		
			Stem ends [3]	.90	6.5	2.9	21.0			86.2	.001	.003		
23710 [1]	10 lbs. com. dry Bordeaux, 1 lb. lead arsenate (powder), 50 galls. water.[2]	do	Whole	.18	1.2	.6	3.9	1.4	9.1	84.6	.016	.054	.127	90.6
			Pulp	.06	.4	.2	1.3	.6	4.0	85.0	.005	.015	.046	
			Skin	.50	2.4	1.7	8.1	3.2	15.2	79.0	.006	.020	.039	
			Calyx	3.90	19.7	13.6	68.7	29.5	149.0	80.2	.004	.014	.032	
			Stem ends	1.10	7.1	3.6	23.4	7.6	49.3	84.6	.001	.005	.010	
			Skin [3]	.50	2.4	1.7	8.1	3.2	15.2	79.0	.006	.020	.039	
			Calyx [3]	3.90	19.7	13.6	68.7	14.7	74.2	80.2	.004	.014	.016	
			Stem ends [3]	1.10	7.1	3.6	23.4	7.6	49.3	84.6	.001	.005	.010	
23283 [4]	Check plat (unsprayed) [5]		Whole	.16	1.0	.5	3.2			84.4	.021	.064		128.8
23284 [4]	10 lbs. lead arsenate (paste), 200 galls. water (coarse nozzle, 185 lbs. pressure).	April 30.	do	.80	5.1	2.6	16.5			84.2	.074	.242		93.0
			Pulp	.10	.7	.2	1.4			85.5	.007	.015		
			Skin	3.00	15.5	11.0	57.0			80.7	.039	.143		
			Calyx	8.00	46.2	25.6	148.0			82.7	.014	.046		
	5 lbs. lead arsenate (powder), 200 galls. water (fine nozzle, 200 lbs. pressure).[5]	May 13, June 19.	Stem ends	6.50	38.7	17.1	101.8			83.2	.014	.038		
			Skin [3]	3.00	15.5	11.0	57.0			80.7	.039	.143		
			Calyx [3]	8.00	46.2	25.6	148.0			82.7	.014	.046		
			Stem ends [3]	6.50	38.7	17.1	101.8			83.2	.014	.038		
23302 [4]	75 lbs. lime, 25 lbs. lead arsenate (41 lbs. applied to trees of medium size, 40 trees in plat) (dust applications).	Apr. 27.	Whole	.46	2.8	1.3	7.9			83.5	.069	.194		149.0
			Pulp	.08	.5	.2	1.3			84.0	.010	.024		
			Skin	1.40	7.3	4.0	20.9			80.9	.027	.076		
	(38.5 lbs. applied to 40 trees)	May 10.	Calyx	4.40	25.0	12.6	71.6			82.4	.015	.044		
	(22.5 lbs. applied to 40 trees)	June 19.	Stem ends	5.20	30.8	15.7	92.9			83.1	.017	.050		
	(26 lbs. applied to 40 trees)	July 21.	Skin [3]	1.40	7.3	4.0	20.9			80.9	.027	.076		
	(32 lbs. applied to 40 trees) [6]	Aug. 9.	Calyx [3]	2.40	13.6	9.6	54.5			82.4	.008	.034		
			Stem ends [3]	5.20	30.8	15.7	92.9			83.1	.017	.050		

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
		1915.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
23303 [4]	45 lbs. lime, 40 lbs. sulphur, 15 lbs. lead arsenate (57 lbs. applied to trees of medium size; 40 trees in plat) (dust applications).	Apr. 27.	Whole	0.40	2.6	1.2	7.8	....	....	84.7	0.061	0.183	....	152.9
			Pulp	.08	.5	.2	1.4	....	....	85.3	.010	.025	....	
			Skin	1.30	6.9	4.0	21.3	....	....	81.2	.026	.079	....	
			Calyx	3.30	18.5	10.9	61.2	....	....	82.2	.011	.036	....	
	(38.5 lbs. applied to 40 trees)	May 10.	Stem ends	4.10	25.0	12.9	78.7	....	....	83.6	.014	.043	....	
	(33.5 lbs. applied to 40 trees)	June 19.	Skin [3]	1.30	6.9	4.0	21.3	....	....	81.2	.026	.079	....	
	(30 lbs. applied to 40 trees) [6]	July 21.	Calyx [3]	3.30	18.5	10.9	61.2	....	....	82.2	.011	.036	....	
	(39 lbs. applied to 40 trees)	Aug. 9.	Stem ends [3]	4.10	25.0	12.9	78.7	....	....	83.6	.014	.043	....	
23435 [4]	10 lbs. lead arsenate (paste), 200 galls. water (coarse nozzle, 140 lbs. pressure).	Apr. 30.	Whole	.80	5.2	2.2	14.3	....	....	84.6	.099	.271	....	123.4
			Pulp	.20	1.3	.4	2.7	....	....	85.1	.021	.041	....	
	5 lbs. lead arsenate (powder), 200 galls. water (fine nozzle, 140 lbs. pressure).[7]	May 13, June 19, July 26.	Skin	2.70	14.9	8.0	44.2	....	....	81.9	.043	.126	....	
			Calyx	8.30	48.5	25.3	147.9	....	....	82.9	.016	.048	....	
			Stem ends	9.50	59.4	27.9	174.4	....	....	84.0	.019	.056	....	
			Skin [3]	2.70	14.9	8.0	44.2	....	....	81.9	.043	.126	....	
			Calyx [3]	8.30	48.5	25.3	147.9	....	....	82.9	.016	.048	....	
			Stem ends [3]	9.50	59.4	27.9	174.4	....	....	84.0	.019	.056	....	
23461 [8]	10 lbs. lead arsenate (paste), 200 galls. water (coarse nozzle, 180 lbs. pressure).	May 3.	Whole	1.10	7.1	3.3	21.4	....	....	84.6	.102	.306	....	92.8
			Pulp	.20	1.4	.4	2.8	....	....	85.6	.016	.032	....	
	(Fine nozzle, 180 lbs. pressure) [9]	May 16, June 21, July 27.	Skin	3.70	18.3	11.2	55.4	....	....	79.8	.042	.126	....	
			Calyx	18.00	94.7	58.3	306.8	....	....	81.0	.018	.058	....	
			Stem ends	21.70	121.9	75.2	422.5	....	....	82.2	.026	.090	....	
			Skin [3]	3.70	18.3	11.2	55.4	....	....	79.8	.042	.126	....	
			Calyx [3]	18.00	94.7	58.3	306.8	....	....	81.0	.018	.058	....	
			Stem ends [3]	18.70	105.1	60.8	341.6	....	....	82.2	.022	.073	....	
23597 [10]	10 lbs. lead arsenate (paste), 200 galls. water (coarse nozzle, 165 lbs. pressure).	Apr. 30.	Whole	1.60	10.5	4.8	31.4	....	....	84.7	.166	.497	....	103.6
			Pulp	.20	1.4	.5	3.4	....	....	85.2	.017	.044	....	
			Skin	5.00	26.0	14.8	77.1	....	....	80.8	.068	.200	....	
			Calyx	21.10	109.9	68.0	354.2	....	....	80.8	.027	.088	....	
	5 lbs. lead arsenate (powder), 200 galls. water (coarse nozzle, 165 lbs. pressure).[11]	May 14, June 20, July 24.	Stem ends	36.20	205.7	110.2	626.1	....	....	82.4	.054	.165	....	
			Skin [3]	3.90	20.3	11.3	58.9	....	....	80.8	.053	.152	....	
			Calyx [3]	15.00	78.1	37.5	195.3	....	....	80.8	.019	.049	....	
			Stem ends [3]	28.50	161.9	79.7	452.8	....	....	82.4	.043	.120	....	
23598 [10]	10 lbs. lead arsenate (paste), 200 galls. water (coarse nozzle, 165 lbs. pressure) purposely oversprayed.	Apr. 30.	Whole	2.90	18.6	8.4	53.8	....	....	84.4	.314	.911	....	108.5
			Pulp	.20	1.3	.7	4.7	....	....	85.0	.018	.064	....	
			Skin	10.40	53.3	30.1	154.4	....	....	80.5	.141	.409	....	
			Calyx	27.20	140.2	81.5	420.1	....	....	80.6	.038	.114	....	
			Stem ends	78.10	464.9	216.3	1,287.5	....	....	83.2	.117	.324	....	
			Skin [3]	3.40	17.4	11.7	60.0	....	....	80.5	.046	.159	....	
			Calyx [3]	15.90	82.0	38.4	197.9	....	....	80.6	.022	.054	....	
	5 lbs. lead arsenate (powder), 200 galls. water (fine nozzle, 200 lbs. pressure) purposely oversprayed.[11]	May 14, June 20, July 24.	Stem ends [3]	56.40	335.7	130.4	776.2	....	....	83.2	.085	.196	....	

23923[6]	Check plat (unsprayed)[11]		Whole	.30	1.9	1.0	6.4			84.4	.025	.084		83.9
23924	1½ galls. lime-sulphur (32° B.), 50 galls. water	Apr. 27.	do	.37	2.4	1.2	7.7			84.5	.048	.155		128.8
			Pulp	.10	.7	.4	2.7			85.4	.011	.040		
			Skin	1.00	4.8	3.4	16.3			79.2	.017	.057		
	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed to a drip).[12]	May 15, June 11, Aug. 10.	Calyx	3.40	18.4	10.2	55.1			81.5	.006	.018		
			Stem ends	7.30	49.3	20.1	135.8			85.2	.014	.040		
			Skin[3]	1.00	4.8	3.4	16.3			79.2	.017	.057		
			Calyx[3]	3.40	18.4	10.2	55.1			81.5	.006	.018		
			Stem ends[3]	7.30	49.3	20.1	135.8			85.2	.014	.040		
23926	1½ galls. lime-sulphur (32° B.), 50 galls. water	Apr. 27.	Whole	.17	1.1					84.3	.020			118.9
			Pulp	.10	.7					85.8	.010			
			Skin	.30	1.5					80.3	.005			
	2 lbs. calcium arsenate (paste) (12.5 per cent As_2O_5), 1½ galls. lime-sulphur, 50 galls. water (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 14.	Calyx	1.80	10.7					83.2	.004			
			Stem ends	.40	2.7					85.3	.001			
			Skin[3]	.30	1.5					80.3	.005			
			Calyx[3]	1.80	10.7					83.2	.004			
			Stem ends[3]	.40	2.7					85.3	.001			
23927	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 27.	Whole	.26	1.6	0.8	5.0			84.1	.028	.088		110.4
			Pulp	.10	.7	.3	2.0			85.2	.009	.031		
			Skin	.80	3.7	2.8	13.0			78.5	.011	.041		
	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur, 50 galls. water (fine nozzle, 180–225 lbs. pressure).[12]	May 17.	Calyx	2.40	13.0	4.6	24.9			81.5	.004	.008		
			Stem ends	1.90	12.3	4.5	29.0			84.5	.004	.008		
			Skin[3]	.80	3.7	2.8	13.0			78.5	.011	.041		
			Calyx[3]	2.40	13.0	4.6	24.9			81.5	.004	.008		
			Stem ends[3]	1.90	12.3	4.5	29.0			84.5	.004	.008		
23928	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.34	2.0			0.7	4.1	82.8	.039		.081	116.7
			Pulp	.10	.6			.5	3.2	84.6	.010		.048	
	$5\frac{8}{10}$ ozs. Paris green, 4-4-50 Bordeaux, 1 lb. stone lime (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 17.	Skin	1.20	5.6			.6	2.8	78.6	.020		.010	
			Calyx	2.20	10.3			6.7	31.3	78.6	.004		.011	
			Stem ends	2.80	16.3			6.6	38.4	82.8	.005		.012	
			Skin[3]	1.20	5.6			.6	2.8	78.6	.020		.010	
			Calyx[3]	2.20	10.3			6.7	31.3	78.6	.004		.011	
			Stem ends[3]	2.80	16.3			6.6	38.4	82.8	.005		.012	
23929	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.40	2.4	1.3	7.7			83.1	.052	.168		129.9
			Pulp	.10	.7	.3	2.0			85.3	.011	.039		
	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur, 50 galls. water (fine nozzle, 110 lbs. pressure) (sprayed to a very mild drip).[12]	May 17, June 11, Aug. 10.	Skin	1.20	5.9	3.7	18.0			79.5	.020	.062		
			Calyx	3.00	16.5	8.8	48.4			81.8	.007	.019		
			Stem ends	5.60	36.8	19.1	125.7			84.8	.014	.048		
			Skin[3]	1.20	5.9	3.7	18.0			79.5	.020	.062		
			Calyx[3]	3.00	16.5	8.8	48.4			81.8	.007	.019		
			Stem ends[3]	5.60	36.8	19.1	125.7			84.8	.014	.048		
23930	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.70	4.5	2.1	13.5			84.5	.083	.249		118.6
			Pulp	.06	.4	.3	2.0			85.4	.006	.035		
	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur, 50 galls. water (sprayed to a strong drip) (larger nozzle, 210 lbs. pressure).[12]	May 17, June 11, Aug. 10.	Skin	2.80	13.2	7.3	34.4			78.8	.043	.112		
			Calyx	6.80	38.0	19.0	106.1			82.1	.013	.036		
			Stem ends	10.70	69.9	33.0	215.7			84.7	.021	.066		
			Skin[3]	1.40	6.6	4.2	19.8			78.8	.021	.064		
			Calyx[3]	6.80	38.0	19.0	106.1			82.1	.013	.036		
			Stem ends[3]	6.60	43.1	16.4	107.2			84.7	.013	.032		

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time.*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple
		1915.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
23931	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28, 1915.	Whole	0.90	6.0	2.9	19.2	....	....	84.9	0.119	0.384	....	132.4
			Pulp	.06	.4	.3	2.0	....	....	85.5	.007	.039	....	
	2½ lbs. lead arsenate (powder), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed to a drip) (fine nozzle, 180 lbs. pressure).[12]	May 17, June 12, Aug. 10.	Skin	3.50	17.2	10.2	50.0	....	....	79.6	.064	.188	....	
			Calyx	9.60	52.7	34.0	186.8	....	....	81.8	.017	.061	....	
			Stem ends	15.30	100.0	48.0	313.7	....	....	84.7	.031	.096	....	
			Skin[3]	2.20	10.8	9.5	46.6	....	....	79.6	.040	.174	....	
			Calyx[3]	8.50	46.7	18.5	101.6	....	....	81.8	.015	.033	....	
			Stem ends[3]	9.90	64.7	37.0	241.8	....	....	84.7	.020	.074	....	
23932	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.50	3.0	1.5	9.1	....	....	83.6	.063	.191	....	127.1
			Pulp	.14	.9	.4	2.5	....	....	84.1	.015	.041	....	
	10 lbs. lead arsenate (powder), 50 lbs. hydrated lime, 40 lbs. sulphur (dust applications).[12]	May 14, June 10, Aug. 9.	Skin	1.20	5.4	3.6	16.1	....	....	77.6	.019	.058	....	
			Calyx	5.60	27.9	17.5	87.1	....	....	79.9	.011	.035	....	
			Stem ends	8.30	49.1	26.0	153.8	....	....	83.1	.018	.057	....	
			Skin[3]	1.20	5.4	3.6	16.1	....	....	77.6	.019	.058	....	
			Calyx[3]	2.90	14.4	11.4	56.7	....	....	79.9	.006	.023	....	
			Stem ends[3]	8.30	49.1	26.0	153.8	....	....	83.1	.018	.057	....	
23933	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.90	5.7	3.2	20.3	....	....	84.2	.134	.476	....	148.7
			Pulp	.06	.4	.4	2.7	....	....	85.1	.007	.050	....	
	25 lbs. lead arsenate (powder), 75 lbs. sulphur (dust applications).[12]	May 14, June 10, Aug. 9.	Skin	2.70	13.4	8.2	40.6	....	....	79.8	.054	.166	....	
			Calyx	14.50	78.4	53.2	287.6	....	....	81.5	.032	.117	....	
			Stem ends	16.20	102.5	57.2	362.0	....	....	84.2	.041	.143	....	
			Skin[3]	2.70	13.4	8.2	40.6	....	....	79.8	.054	.166	....	
			Calyx[3]	14.50	78.4	53.2	287.6	....	....	81.5	.032	.117	....	
			Stem ends[3]	16.20	102.5	57.2	362.0	....	....	84.2	.041	.143	....	
23934	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.50	3.1	1.5	9.3	....	....	84.0	.058	.174	....	115.9
			Pulp	.06	.4	.3	2.0	....	....	85.5	.005	.024	....	
	15 lbs. lead arsenate (powder), 40 lbs. sulphur, 45 lbs. terra alba (dust applications).[12]	May 14, June 11, Aug. 9.	Skin	1.50	7.1	4.3	20.4	....	....	78.9	.023	.067	....	
			Calyx	8.80	46.8	24.2	128.7	....	....	81.2	.015	.041	....	
			Stem ends	7.50	48.1	21.0	134.6	....	....	84.4	.015	.042	....	
			Skin[3]	1.50	7.3	4.3	20.4	....	....	78.9	.023	.067	....	
			Calyx[3]	8.80	46.8	24.2	128.7	....	....	81.2	.015	.041	....	
			Stem ends[3]	7.50	48.1	21.0	134.6	....	....	84.4	.015	.042	....	
23935	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.33	2.1	.5	3.2	....	....	84.4	.042	.064	....	127.3
			Pulp	.10	.7	.3	2.0	....	....	85.3	.010	.032	....	
	10 lbs. lead arsenate (powder), 60 lbs. barium polysulphid, 30 lbs. terra alba (dust applications).[12]	May 14, June 11, Aug. 9.	Skin	.90	4.2	1.2	5.6	....	....	78.6	.014	.020	....	
			Calyx	3.60	18.9	2.2	11.6	....	....	81.0	.008	.005	....	
			Stem ends	4.00	25.3	2.8	17.7	....	....	84.2	.010	.007	....	
			Skin[3]	.90	4.2	1.2	5.6	....	....	78.6	.014	.020	....	
			Calyx[3]	3.60	18.9	2.2	11.6	....	....	81.0	.008	.005	....	
			Stem ends[3]	4.00	25.3	2.8	17.7	....	....	84.2	.010	.007	....	

23937	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	0.42	2.9					85.5	.055			131.5
			Pulp	.09	.6					86.0	.010			
	2 lbs. calcium arsenate (paste) (12.5 per cent As_2O_5), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 14, June 12, Aug. 10.	Skin	1.50	7.5					80.0	.026			
			Calyx	3.90	21.7					82.0	.007			
			Stem ends	5.90	39.9					85.2	.012			
			Skin [3]	1.00	5.0					80.0	.018			
			Calyx [3]	1.60	8.9					82.0	.003			
			Stem ends [3]	4.60	31.1					85.2	.010			
23938	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.42	2.8					85.0	.048			113.2
			Pulp	.10	.7					86.0	.009			
	9 ozs. calcium arsenate (powder), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 14, June 12, Aug. 10.	Skin	1.50	7.5					80.0	.023			
			Calyx	4.30	24.6					82.5	.009			
			Stem ends	3.10	20.7					85.0	.007			
			Skin [3]	1.20	6.0					80.0	.018			
			Calyx [3]	3.20	18.3					82.5	.007			
			Stem ends [3]	3.10	20.7					85.0	.007			
23939	Check plat (unsprayed) [12]		Whole	.24	1.5	0.7	4.3	0.7	4.3	83.7	.032	.093	.093	132.3
23940	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	do.	.46	2.9	1.5	9.5			84.2	.065	.211		140.6
			Pulp	.10	.7	.3	2.1			85.6	.012	.036		
	1 lb. lead arsenate (powder), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed to a drip) (fine nozzle, 210 lbs. pressure).[12]	May 17, June 11, Aug. 10.	Skin	1.20	5.7	4.0	19.0			78.9	.021	.072		
			Calyx	6.60	36.7	21.5	119.4			82.0	.012	.041		
			Stem ends	9.60	61.9	29.5	190.3			84.5	.020	.062		
			Skin [3]	1.20	5.7	4.0	19.0			78.9	.021	.072		
			Calyx [3]	4.30	23.9	13.0	72.2			82.0	.008	.025		
			Stem ends [3]	9.60	61.9	29.5	190.3			84.5	.020	.062		
23941	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.34	2.2	.6	3.9			84.5	.040	.071		119.0
			Pulp	.10	.7	.2	1.4			85.9	.010	.020		
	1 lb. lead arsenate (powder), 4 lbs. barium polysulphid, 50 galls. water (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 17, June 12, Aug. 10.	Skin	.90	4.6	1.9	9.7			80.4	.015	.031		
			Calyx	3.80	22.4	4.7	27.6			83.0	.006	.008		
			Stem ends	4.50	31.2	6.0	41.7			85.6	.009	.012		
			Skin [3]	.90	4.6	1.9	9.7			80.4	.015	.031		
			Calyx [3]	3.80	22.4	4.7	27.6			83.0	.006	.008		
			Stem ends [3]	4.50	31.2	6.0	41.7			85.6	.009	.012		
23942	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 28.	Whole	.40	1.9			5.2	24.2	78.5	.029		.380	73.0
			Pulp	.10	.5			.8	3.9	79.3	.006		.049	
	$5\frac{3}{10}$ ozs. Paris green, 4-5-50 Bordeaux (sprayed to a drip) (fine nozzle, 180–225 lbs. pressure).[12]	May 18, June 18, Aug. 14.	Skin	1.60	6.3			28.5	111.3	74.4	.015		.273	
			Calyx	3.00	12.4			19.3	79.8	75.8	.004		.023	
			Stem ends	3.10	14.3			29.4	136.1	78.4	.004		.035	
			Skin [3]	1.60	6.3			28.5	111.3	74.4	.015		.273	
			Calyx [3]	3.00	12.4			11.6	47.9	75.8	.004		.014	
			Stem ends [3]	3.10	14.3			21.2	98.1	78.4	.004		.025	
23943	1½ galls. lime-sulphur (32° B.), 50 galls. water.	Apr. 30.	Whole	.50	3.3	1.5	9.9			84.8	.054	.161		107.4
			Pulp	.17	1.2	.4	2.8			85.9	.015	.036		
	2 lbs. lead arsenate (paste), 1½ galls. lime-sulphur (32° B.), 50 galls. water (sprayed by orchardist without supervision).[12]	May 19, June 14, Aug. 11.	Skin	1.50	7.6	4.3	21.7			80.2	.021	.060		
			Calyx	7.00	38.9	23.0	127.8			82.0	.010	.035		
			Stem ends	5.60	36.8	19.8	130.3			84.8	.008	.030		
			Skin [3]	1.50	7.6	4.3	21.7			80.2	.021	.060		
			Calyx [3]	7.00	38.9	23.0	127.8			82.0	.010	.035		
			Stem ends [3]	4.00	26.3	11.3	74.3			84.8	.006	.017		

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time.*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1915.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
23575[4]	2 lbs. lead arsenate (paste), 50 galls. water (first application with Bean Clipper nozzle; Friend mist nozzle, 2 to the rod, on all remaining applications) (200 lbs. pressure).[13]	May 5-7, 24-26, June 14-15, July 16-17, Aug. 6-9.	Whole	3.60	21.7	8.9	53.6			83.4	0.512	1.265		142.2
			Pulp	.24	1.5	1.0	6.1			83.7	.029	.122		
			Skin	20.20	106.9	48.7	257.7			81.1	.341	.823		
			Calyx	46.50	242.2	98.3	512.0			80.8	.074	.157		
			Stem ends	36.00	213.0	86.0	508.9			83.1	.068	.163		
			Skin [3]	12.80	67.7	30.2	159.8			81.1	.216	.510		
			Calyx [3]	46.50	242.0	98.3	512.0			80.8	.074	.157		
			Stem ends [3]	33.30	197.0	81.2	480.5			83.1	.063	.154		
23576[4]	2 lbs. lead arsenate (paste), 50 galls. water (Vermorel nozzle, 2 nozzles to each 10 ft.; spray rod) (100 lbs. pressure).[13]	do	Whole	3.70	21.6	8.9	52.0			82.9	.431	1.036		116.4
			Pulp	.10	.6	1.0	6.0			83.3	.010	.099		
			Skin	19.00	96.4	46.0	233.5			80.3	.274	.662		
			Calyx	49.00	233.3	97.3	463.3			79.0	.059	.117		
			Stem ends	54.80	299.5	98.7	539.3			81.7	.088	.158		
			Skin [3]	16.30	82.7	27.5	139.6			80.3	.235	.396		
			Calyx [3]	40.50	192.9	88.4	421.0			79.0	.049	.106		
			Stem ends [3]	54.80	299.5	98.7	539.3			81.7	.088	.158		
23577[4]	¾ lb. com. calcium arsenate (powder), 50 galls. water (first application with Bean Clipper nozzle; Friend mist nozzle, 2 to the rod, on all remaining applications).[13]	do	Whole	2.40	15.9					84.9	.279			116.3
			Pulp	.36	2.5					85.8	.035			
			Skin	6.90	39.7					82.6	.108			
			Calyx	39.40	220.1					82.1	.055			
			Stem ends	45.20	295.4					84.7	.081			
			Skin [3]	6.10	35.0					82.6	.095			
			Calyx [3]	37.40	208.9					82.1	.052			
			Stem ends [3]	45.20	295.4					84.7	.081			
23578[4]	Check plat (unsprayed)[13]		Whole	.32	2.0	1.5	9.3			83.9	.038	.178		118.7
23579[4]	4 lbs. lead arsenate (powder) to 250-gall. tank, or 12.8 ozs., 50 galls. water (Bordeaux nozzle, 225 lbs. pressure) (coarse penetrating spray) (rained June 4, 5, 6; so sprayed immediately on June 8).[13]	May 6, 24, June 3, 8, 17, 29, July 13, 26, Aug. 9, 24.	do	5.00	29.6	12.7	75.1			83.1	.738	1.872		147.5
			Pulp	.33	2.0	1.4	8.5			83.5	.041	.173		
			Skin	23.00	114.4	55.1	274.1			79.9	.437	1.047		
			Calyx	44.60	212.4	103.6	493.3			79.0	.098	.228		
			Stem ends	60.00	329.7	157.1	863.2			81.8	.162	.424		
			Skin [3]	16.90	84.1	31.0	154.2			79.9	.321	.589		
			Calyx [3]	44.60	212.4	103.6	493.3			79.0	.098	.228		
			Stem ends [3]	42.50	233.5	86.5	475.3			81.8	.115	.234		
23716[10]	2 lbs. lead arsenate (paste), 50 galls. water (first application with Bean Clipper nozzle; Friend mist nozzle, 2 to the rod, on	May 5-7, 24-26, June 14-15, July 16-17, Aug. 6-9.	Whole	4.80	30.0	13.9	86.9			84.0	.792	2.295		165.0
			Pulp	.17	1.1	.9	6.0			85.1	.023	.119		
			Skin	18.00	96.8	51.6	263.3			81.4	.363	1.042		

	all remaining applications) (200 lbs. pressure).[14]		Calyx	67.30	345.1	159.1	815.9			80.5	.154	.366		
			Stem ends	97.00	606.2	295.3	1,845.6			84.0	.252	.768		
			Skin [3]	10.10	54.3	24.8	133.3			81.4	.205	.501		
			Calyx [3]	55.40	284.1	144.1	739.0			80.5	.127	.332		
			Stem ends [3]	65.50	409.4	201.7	1,260.6			84.0	.170	.524		
23717[10]	2 lbs. lead arsenate (paste), 50 galls. water (Vermorel nozzles, 2 to each 10 ft. spray rod) (100 lbs. pressure).[14]	do	Whole	3.80	24.0	10.6	67.1			84.2	.616	1.720		162.2
			Pulp	.30	1.9	1.1	7.1			84.4	.042	.153		
			Skin	15.70	80.5	44.9	230.3			80.5	.281	.804		
			Calyx	62.40	313.6	168.9	848.7			80.1	.143	.388		
			Stem ends	55.60	323.3	139.1	808.7			82.8	.150	.375		
			Skin [3]	9.40	48.2	25.4	130.3			80.5	.168	.455		
			Calyx [3]	31.30	157.3	87.1	437.7			80.1	.072	.200		
			Stem ends [3]	55.60	323.3	139.1	808.7			82.8	.150	.375		
23718[10]	¾ lb. com. calcium arsenate (powder), 50 galls. water (first application with Bean Clipper nozzle; Friend mist nozzle, 2 to the rod on all remaining applications) (200 lbs. pressure).[14]	do	Whole	2.50	15.6					84.0	.372			149.0
			Pulp	.30	2.0					85.2	.038			
			Skin	9.30	47.9					81.6	.156			
			Calyx	38.10	203.7					81.3	.084			
			Stem ends	36.10	228.5					84.2	.094			
			Skin [3]	5.10	27.7					81.6	.085			
			Calyx [3]	28.30	151.3					81.3	.062			
			Stem ends [3]	36.10	228.5					84.2	.094			
23719[10]	Check plat (unsprayed)[14]		Whole	.33	2.2	1.1	7.2			84.8	.051	.168		153.9
23720[10]	4 lbs. lead arsenate (powder) to 250-gall. tank, or 12.8 oz., 50 galls. water (Bordeaux nozzle used) (225 lbs. pressure) (rained June 4, 5, 6; so sprayed immediately on June 8).[14]	May 5, 24, June 3, 9, 11, 13, 26, Aug. 9, 24.	do	5.40	31.2	14.3	82.7			82.7	.743	1.968		137.6
			Pulp	.30	1.8	1.4	8.5			83.6	.035	.163		
			Skin	25.70	125.4	67.5	329.3			79.5	.442	1.161		
			Calyx	77.50	342.9	192.5	851.8			77.4	.140	.346		
			Stem ends	74.40	413.3	175.5	975.0			82.0	.126	.298		
			Skin [3]	15.60	76.1	48.9	238.5			79.5	.268	.841		
			Calyx [3]	48.00	212.4	130.3	576.5			77.4	.086	.234		
			Stem ends [3]	62.50	347.2	156.9	871.7			82.0	.106	.266		
23721[8]	4 lbs. lead arsenate (powder) to 250-gall. tank, or 12.8 oz., 50 galls. water (Bordeaux nozzle used) (225 lbs. pressure) (rained June 4, 5, 6; so sprayed immediately on June 8).[14]	May 8, 10, 25, 26, June 4, 7, 16, 28, 29, July 13, 26, Aug. 9, 25.	Whole	5.50	26.7	15.3	74.3			79.4	.605	1.684		110.1
			Pulp	.40	2.1	1.4	7.3			80.8	.037	.128		
			Skin	22.70	92.3	63.0	256.1			75.4	.345	.958		
			Calyx	71.80	297.9	198.8	824.9			75.9	.108	.298		
			Stem ends	67.90	318.8	176.7	829.6			78.7	.115	.300		
			Skin [3]	22.70	92.3	63.0	256.1			75.4	.345	.958		
			Calyx [3]	60.30	250.2	173.2	718.7			75.9	.090	.260		
			Stem ends [3]	49.70	233.3	142.1	667.1			78.7	.084	.242		
23722[8]	Check plat (unsprayed)[14]		Whole	.44	2.2	1.5	7.6			80.2	.042	.144		96.3
		1916.												
26024[1]	Check plat (unsprayed)[1]		do	.04	.3	.2	1.3			84.4	.006	.031		155.0
26025[1]	1⅔ galls. lime-sulphur, 1 lb. lead arsenate (powder), 50 galls. water (standard spray used in this locality).[15]	May 1, 15, June 5, July 10.	do	.10	.6	.4	2.4			83.6	.016	.063		158.0
			Pulp	.04	.3	.2	1.3			84.4	.005	.026		
			Skin	.30	1.4	.7	3.3			78.8	.006	.014		
			Calyx	1.20	6.3	7.0	36.8			81.0	.001	.010		
			Stem ends	2.60	14.3	8.0	44.0			81.8	.004	.013		
			Skin [16]	.30	1.4	.7	3.3			78.8	.006	.014		
			Calyx [16]	1.20	6.3	7.0	36.8			81.0	.001	.010		
			Stem ends [16]	2.60	14.3	8.0	44.0			81.8	.004	.013		

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1916.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
25884[10]	1 lb. lead arsenate (powder), 50 galls. water (coarse nozzle) (12 galls. per tree each application) (18-year-old trees).[17]	Apr. 19, 24, May 3, June 10.	Whole	0.50	2.9	1.3	7.6	....	....	82.9	0.059	0.153	....	118.0
			Pulp	.10	.6	.5	3.1	....	....	84.1	.010	.050	....	
			Skin	.50	2.3	2.0	9.4	....	....	78.7	.007	.030	....	
			Calyx	15.20	74.5	25.3	124.0	....	....	79.6	.023	.038	....	
			Stem ends	12.80	74.0	23.3	134.7	....	....	82.7	.019	.035	....	
			Skin[16]	.50	2.3	2.0	9.4	....	....	78.7	.007	.030	....	
			Calyx[16]	8.90	43.6	10.4	51.0	....	....	79.6	.013	.016	....	
			Stem ends[16]	12.80	74.0	23.3	134.7	....	....	82.7	.019	.035	....	
25885[10]	1 lb. lead arsenate (powder), 50 galls. water (fine nozzle) (11 galls. per tree each application) (18-year-old trees).[17]	Apr. 19, May 3, June 10, July 10.	Whole	.70	4.3	1.9	11.7	....	....	83.7	.083	.224	....	118.0
			Pulp	.10	.7	.5	3.4	....	....	85.5	.010	.050	....	
			Skin	1.50	7.1	4.8	22.9	....	....	79.0	.023	.072	....	
			Calyx	9.00	42.5	14.4	67.9	....	....	78.8	.013	.021	....	
			Stem ends	25.00	138.1	53.9	297.8	....	....	81.9	.037	.081	....	
			Skin[16]	.90	4.3	3.0	14.3	....	....	79.0	.013	.045	....	
			Calyx[16]	6.70	31.6	9.0	42.5	....	....	78.8	.010	.013	....	
			Stem ends[16]	15.30	84.5	27.4	151.4	....	....	81.9	.023	.041	....	
25886[10]	10 lbs. lead arsenate, 90 lbs. hydrated lime (dust sprayed) (2¼ lbs. each application) (18-year-old trees).[17]	Apr. 17, 30, June 9, July 11.	Whole	.20	1.2	.8	4.6	....	....	82.7	.024	.094	....	118.0
			Pulp	.03	.2	.3	1.9	....	....	84.0	.003	.030	....	
			Skin	.50	2.3	1.5	6.8	....	....	77.9	.007	.023	....	
			Calyx	1.60	7.4	5.6	25.8	....	....	78.3	.002	.008	....	
			Stem ends	8.00	42.1	22.3	117.4	....	....	81.0	.012	.033	....	
			Skin[16]	.50	2.3	1.5	6.8	....	....	77.9	.007	.023	....	
			Calyx[16]	1.60	7.4	5.6	25.8	....	....	78.3	.002	.008	....	
			Stem ends[16]	8.00	42.1	22.3	117.4	....	....	81.0	.012	.033	....	
25887[10]	15 lbs. lead arsenate, 85 lbs. hydrated lime (dust sprayed) (2¼ lbs. each application) (18-year-old trees).[17]	....do	Whole	.30	1.8	.9	5.3	....	....	83.0	.035	.106	....	118.0
			Pulp	.05	.3	.3	1.9	....	....	84.4	.005	.030	....	
			Skin	.30	1.5	.9	4.4	....	....	79.6	.004	.014	....	
			Calyx	9.00	45.2	15.8	79.4	....	....	80.1	.014	.023	....	
			Stem ends	8.20	48.2	26.1	153.5	....	....	83.0	.012	.039	....	
			Skin[16]	.30	1.5	.9	4.4	....	....	79.6	.004	.014	....	
			Calyx[16]	6.20	31.2	8.9	44.7	....	....	80.1	.009	.013	....	
			Stem ends[16]	7.00	41.2	21.4	125.9	....	....	83.0	.011	.032	....	
25888[10]	20 lbs. lead arsenate, 80 lbs. hydrated lime (dust sprayed) (2¼ lbs. each application) (18-year-old trees).[17]	....do	Whole	.30	1.8	.9	5.3	....	....	83.0	.035	.106	....	118.0
			Pulp	.05	.3	.3	1.9	....	....	84.5	.005	.030	....	
			Skin	.30	1.4	1.0	4.7	....	....	78.9	.004	.015	....	
			Calyx	7.70	37.2	13.5	65.2	....	....	79.3	.011	.020	....	
			Stem ends	10.00	56.2	27.3	153.4	....	....	82.2	.015	.041	....	
			Skin[16]	.20	.9	.5	2.4	....	....	78.9	.003	.007	....	
			Calyx[16]	2.00	9.7	4.2	20.3	....	....	79.3	.003	.006	....	
			Stem ends[16]	4.20	36.5	13.8	77.5	....	....	82.2	.006	.021	....	

26012[10]	7½ lbs. calcium arsenate, 92½ lbs. hydrated lime (dust sprayed) (2¼ lbs. each application) (18-year-old trees).[17]	do.	Whole	.80	4.7					83.0	.094			118.0
			Pulp	.08	.5					84.3	.008			
			Skin	1.90	8.9					78.7	.028			
			Calyx	13.00	61.6					78.9	.019			
			Stem ends	25.80	143.3					82.0	.039			
			Skin[16]	1.40	6.6					78.7	.021			
			Calyx[16]	4.00	19.0					78.9	.006			
			Stem ends[16]	19.40	107.8					82.0	.029			
26047[10]	Check plat (unsprayed)[17]		Whole	.10	.6	0.6	3.4			82.4	.012	.071		118.0
26286[10]	50 per cent sulphur, 50 per cent hydrated lime. 50 per cent sulphur, 45 per cent hydrated lime, 5 per cent lead arsenate (powder) (1.9 lbs. dust per tree each application) (15-year-old trees).[18]	May 9. May 19, June 12, Aug. 5.	do	.13	.8	.8	4.8			83.3	.018	.109		135.8
			Pulp	.06	.4	.5	3.1			84.0	.006	.058		
			Skin	.30	1.4	1.6	7.2			77.8	.005	.026		
			Calyx	1.00	4.9	4.5	21.8			79.4	.001	.006		
			Stem ends	3.50	20.6	12.1	71.2			83.0	.006	.019		
			Skin[16]	.30	1.4	1.6	7.2			77.8	.005	.026		
			Calyx[16]	1.00	4.9	4.5	21.8			79.4	.001	.006		
			Stem ends[16]	3.50	20.6	12.1	71.2			83.0	.006	.019		
26287[10]	4 lbs. barium polysulphid, 2 lbs. lead arsenate (paste), 50 galls. water.[18]	May 10, 20, June 13, Aug. 6.	Whole	.15	.8	.8	4.5			82.2	.022	.116		145.5
			Pulp	.05	.3	.5	3.1			83.9	.006	.062		
			Skin	.40	1.8	1.9	8.3			77.2	.007	.034		
			Calyx	2.40	12.2	4.5	22.8			80.3	.004	.007		
			Stem ends	3.20	18.8	7.7	45.3			83.0	.005	.013		
			Skin[16]	.40	1.8	1.9	8.3			77.2	.007	.034		
			Calyx[16]	2.40	12.2	4.5	22.8			80.3	.004	.007		
			Stem ends[16]	3.20	18.8	7.7	45.3			83.0	.005	.013		
26288[10]	1½ lbs. soluble sulphur, 50 galls. water[18]	do.	Whole	.05	.3	.5	2.7			81.8	.007	.069		138.0
26289[10]	1 lb. soluble sulphur, 50 galls. water[18]	do	do	.04	.2	.4	2.2			82.1	.006	.057		143.0
26420[10]	Commercial mixture of 50 per cent sulphur, 50 per cent lead arsenate (dust application, 1 lb. per tree).[18]	May 9, 19, June 12, Aug. 5.	do	.40	2.5	1.4	8.7			83.9	.052	.185		131.7
			Pulp	.10	.6	.4	2.5			84.3	.011	.044		
			Skin	.70	3.2	2.4	11.1			78.4	.012	.041		
			Calyx	6.00	31.1	17.2	89.1			80.7	.008	.024		
			Stem ends	13.00	77.4	47.2	281.0			83.2	.021	.076		
			Skin[16]	.50	2.3	1.7	7.9			78.4	.009	.029		
			Calyx[16]	6.00	31.1	17.2	89.1			80.7	.008	.024		
			Stem ends[16]	13.00	77.4	47.2	281.0			83.2	.021	.076		
26421[10]	1½ galls. lime-sulphur, 50 galls. water 1½ galls. lime-sulphur, 1 lb. lead arsenate (powder), 50 galls. water.[18]	May 9. May 19, June 12, Aug. 5.	Whole	.30	1.8	1.0	6.1			83.7	.039	.130		130.3
			Pulp	.10	.7	.3	2.0			84.7	.010	.033		
			Skin	.80	3.6	2.3	10.3			77.7	.014	.039		
			Calyx	2.90	14.1	6.2	30.1			79.4	.004	.010		
			Stem ends	6.60	39.1	27.2	160.9			83.1	.011	.048		
			Skin[16]	.60	2.7	1.7	7.6			77.7	.010	.030		
			Calyx[16]	2.90	14.1	6.2	30.1			79.4	.004	.010		
			Stem ends[16]	5.00	29.6	17.1	101.2			83.1	.009	.031		
26422[10]	1½ galls. lime-sulphur, 50 galls. water 1½ galls. lime-sulphur, 50 galls. water, ¾ lb. arsenate of lime (powder).[18]	May 10. May 20, June 13, Aug. 6.	Whole	.20	1.2					83.7	.026			133.8
			Pulp	.10	.6					84.5	.013			
			Skin	.40	1.9					78.5	.007			
			Calyx	1.50	7.8					80.7	.002			
			Stem ends	2.40	14.3					83.2	.004			
			Skin[16]	.30	1.4					78.5	.006			
			Calyx[16]	1.50	7.8					80.7	.002			
			Stem ends[16]	1.60	9.5					83.2	.003			

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As)		Lead (Pb).		Copper (Cu.)		Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1916.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
26540[10]	65 per cent sulphur, 35 per cent hydrated lime.	May 9.	Whole	0.10	0.6					82.1	0.013			129.7
			Pulp	.07	.4					83.5	.007			
	60 per cent sulphur, 32.5 per cent hydrated lime, 7.5 per cent arsenate of lime (dust application).[18]	May 19, June 12, Aug. 5.	Skin	.20	.9					77.6	.003			
			Calyx	1.70	8.1					79.0	.002			
			Stem ends	.90	5.1					82.2	.001			
			Skin [16]	.20	.9					77.6	.003			
			Calyx [16]	1.70	8.1					79.0	.002			
			Stem ends [16]	.90	5.1					82.2	.001			
26541[10]	1½ galls. lime-sulphur (32° B.), 50 galls. water.	May 10.	Whole	.30	1.8	1.0	6.2			83.8	.037	0.126		125.6
			Pulp	.10	.7	.3	2.0			84.7	.010	.031		
	1½ galls. lime-sulphur (32° B.), 50 galls. water, 1 lb. lead arsenate (powder).[18]	May 20, June 13, Aug. 6.	Skin	.80	3.7	2.5	11.6			78.5	.014	.043		
			Calyx	2.30	12.0	8.2	42.9			80.9	.003	.010		
			Stem ends	6.40	39.3	28.4	174.2			83.7	.010	.042		
			Skin [16]	.80	3.7	2.5	11.6			78.5	.014	.043		
			Calyx [16]	2.30	12.0	8.2	42.9			80.9	.003	.010		
			Stem ends [16]	4.80	29.4	22.8	139.9			83.7	.007	.034		
26639[10]	75 per cent sulphur, 25 per cent hydrated lime.	May 9.	Whole	.40	2.5	1.1	6.9			84.1	.047	.130		118.3
			Pulp	.10	.7	.3	2.0			85.3	.010	.030		
	75 per cent sulphur, 10 per cent hydrated lime, 15 per cent lead arsenate (dust applications) (1.9 lbs. per tree per application) (15-year-old trees).[18]	May 19, June 12, Aug. 5.	Skin	.50	2.5	1.5	7.4			79.8	.008	.024		
			Calyx	10.80	59.0	24.5	133.9			81.7	.012	.024		
			Stem ends	15.00	88.2	48.1	282.9			83.0	.017	.052		
			Skin [19]	.50	2.5	1.5	7.4			79.8	.008	.024		
			Calyx [19]	6.40	35.0	17.6	96.2			81.7	.006	.018		
			Stem ends[19]	10.60	62.4	29.4	172.9			83.0	.012	.032		
26640[10]	80 per cent sulphur, 20 per cent lead arsenate (dust applications) (about 1 lb. per tree each application) (15-year-old trees).[18]	May 9, 19, June 12, Aug. 5.	Whole	.30	1.8	1.0	6.1			83.6	.037	.124		124.2
			Pulp	.07	.4	.3	1.9			84.2	.007	.032		
			Skin	.30	1.4	1.8	8.4			78.6	.005	.029		
			Calyx	12.00	59.1	29.8	146.8			79.7	.012	.030		
			Stem ends	11.60	65.5	30.2	170.6			82.3	.013	.033		
			Skin[19]	.30	1.4	1.8	8.4			78.6	.005	.029		
			Calyx[19]	6.40	31.5	15.8	77.8			79.7	.006	.016		
			Stem ends[19]	7.90	44.6	24.0	135.6			82.3	.009	.026		
26682[10]	1 lb. com. Bordeaux (10 per cent Cu), 50 galls. water.[18]	May 10, 19, June 13, Aug. 6.	Whole					1.4	7.8	82.1			0.186	133.3
			Pulp					.6	3.6	83.5			.068	
			Skin					4.6	20.6	77.7			.083	
			Calyx					12.4	57.4	78.4			.012	
			Stem ends					17.4	92.1	81.1			.023	
			Skin[19]					1.9	8.5	77.7			.034	
			Calyx[19]					5.4	25.0	78.4			.005	
			Stem ends[19]					14.6	77.2	81.1			.019	

26683[10]	5 lbs. com. powder (12¼ per cent Cu, 3 per cent As), 50 galls. water.[18]	May 10, 20, June 13, Aug. 6.	Whole	.12	.7	....	....	.7	3.9	82.2	.017	....	.097	138.2
			Pulp	.07	.4	....	....	.5	3.0	83.6	.008	....	.059	
			Skin	.20	.9	....	....	1.0	4.4	77.5	.004	....	.018	
			Calyx	1.00	4.8	....	....	6.6	31.9	79.3	.001	....	.006	
			Stem ends	3.60	19.9	....	....	12.1	66.9	81.9	.004	....	.014	
			Skin[19]	.20	.9	....	....	1.0	4.4	77.5	.004	....	.018	
			Calyx[19]	1.00	4.8	....	....	3.1	15.0	79.3	.001	....	.003	
			Stem ends[19]	3.60	19.9	....	....	10.6	58.6	81.9	.004	....	.013	
26702[10]	65 per cent sulphur, 35 per cent hydrated lime.	May 9.	Whole	.20	1.2	1.0	6.2	....	....	83.8	.023	.116	....	116.0
	65 per cent sulphur, 25 per cent hydrated lime, 10 per cent lead arsenate (dust applications) (1.9 lbs. per tree each application) (15-year-old trees).[18]	May 19, June 12, Aug. 5.	Pulp	.08	.5	.5	3.3	....	....	84.8	.007	.049	....	
			Skin	.20	1.0	1.4	6.8	....	....	79.5	.003	.023	....	
			Calyx	4.00	20.0	11.5	57.5	....	....	80.0	.004	.011	....	
			Stem ends	9.00	51.1	33.2	188.6	....	....	82.4	.009	.033	....	
			Skin[19]	.20	1.0	1.4	6.8	....	....	79.5	.003	.023	....	
			Calyx[19]	2.70	13.5	6.7	33.5	....	....	80.0	.003	.007	....	
			Stem ends[19]	5.70	32.4	21.5	122.2	....	....	82.4	.006	.021	....	
26703[10]	Check plat (unsprayed)[18]	....	Whole	.04	.2	.4	2.4	0.4	2.4	83.1	.005	.050	.050	123.8
26704[10]	1 pt. com. preparation (6.3 per cent lead arsenate, 8 per cent Paris green), 50 galls. water.[18]	May 10, 20, June 13, Aug. 6.	do	.12	.7	.8	4.8	.4	2.4	83.2	.016	.110	.054	137.2
			Pulp	.09	.6	.6	3.7	.3	1.8	83.7	.011	.070	.035	
			Skin	.15	.7	1.6	7.4	.7	3.3	78.4	.003	.029	.013	
			Calyx	.70	3.5	4.4	21.8	2.5	12.4	79.8	.001	.005	.003	
			Stem ends	.7	4.0	5.1	29.0	2.7	15.3	82.4	.001	.006	.003	
			Skin[19]	.15	.7	1.6	7.4	.7	3.3	78.4	.003	.029	.013	
			Calyx[19]	.70	3.5	4.4	21.8	2.5	12.4	79.8	.001	.005	.003	
			Stem ends[19]	.70	4.0	5.1	29.0	2.7	15.3	82.4	.001	.006	.003	
26719[10]	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).	May 2.	Whole	1.20	8.1	4.5	30.2	....	....	85.1	.188	.708	....	157.3
	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray, all applications) (pressure, 200 lbs.).[20]	May 29, July 8, Aug. 18.	Pulp	.04	.3	.7	4.9	....	....	85.8	.005	.094	....	
			Skin	3.70	20.7	12.9	72.1	....	....	82.1	.075	.263	....	
			Calyx	45.80	251.6	148.7	774.5	....	....	81.8	.050	.163	....	
			Stem ends	48.80	299.4	157.0	963.2	....	....	83.7	.058	.188	....	
			Skin[19]	1.70	9.5	6.3	35.2	....	....	82.1	.035	.129	....	
			Calyx[19]	15.80	86.8	61.5	337.9	....	....	81.8	.016	.068	....	
			Stem ends[19]	23.00	141.1	103.6	635.6	....	....	83.7	.028	.124	....	
26720[10]	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray) (pressure, 225 lbs.).	May 2.	Whole	1.20	8.5	4.5	31.9	....	....	85.9	.178	.668	....	148.5
			Pulp	.04	.3	.6	4.5	....	....	86.7	.005	.076	....	
	1 lb. lead arsenate (powder), 50 galls. water (Friend nozzle, mist-like spray) (pressure, 200 lbs.).[20]	May 29, July 8, Aug. 18.	Skin	3.50	20.5	12.8	74.9	....	....	82.9	.068	.250	....	
			Calyx	42.00	241.4	136.1	782.2	....	....	82.6	.046	.150	....	
			Stem ends	49.70	310.6	160.0	1,000.0	....	....	84.0	.059	.192	....	
			Skin[19]	2.00	11.7	8.1	47.4	....	....	82.9	.040	.158	....	
			Calyx[19]	20.50	117.8	86.3	496.0	....	....	82.6	.023	.095	....	
			Stem ends[19]	30.30	189.4	135.3	845.6	....	....	84.0	.036	.162	....	
26758[10]	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).	May 2.	Whole	1.40	9.3	4.7	31.3	....	....	85.0	.214	.718	....	152.8
	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray, all applications) (pressure, 200 lbs.).[20]	May 29, June 16, July 8, Aug. 18.	Pulp	.06	.4	.5	3.6	....	....	86.0	.008	.065	....	
			Skin	5.50	30.9	17.9	100.6	....	....	82.2	.110	.358	....	
			Calyx	29.60	162.6	118.5	651.1	....	....	81.8	.033	.130	....	
			Stem ends	52.90	332.7	137.5	864.8	....	....	84.1	.063	.165	....	
			Skin[19]	1.10	6.2	6.2	34.8	....	....	82.2	.022	.124	....	
			Calyx[19]	10.70	58.8	39.0	214.3	....	....	81.8	.012	.043	....	
			Stem ends[19]	18.80	118.2	59.3	373.0	....	....	84.1	.023	.071	....	

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).		Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Original fruit.	Dried fruit.	Original fruit.	Dried fruit.	Original fruit.	Dried fruit.					
		1916.		*Parts per million.*						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
26963[10]	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray) (pressure, 225 lbs.).	May 2.	Whole	1.40	9.3	4.7	31.3	......	......	85.0	0.216	0.725	......	154.4
			Pulp	.04	.3	.5	3.5	......	......	85.9	.005	.066	......	
			Skin	4.40	25.3	15.1	86.8	......	......	82.6	.088	.302	......	
	1 lb. lead arsenate (powder), 50 galls. water (Friend nozzle, mist-like spray) (pressure, 200 lbs.).[20]	May 29, June 16, July 8, Aug. 18.	Calyx	46.50	256.9	137.6	760.2	......	......	81.9	.051	.151	......	
			Stem ends	59.80	366.9	172.0	1,055.2	......	......	83.7	.072	.206	......	
			Skin[19]	3.40	19.5	10.2	58.6	......	......	82.6	.068	.204	......	
			Calyx[19]	19.20	106.1	78.7	434.8	......	......	81.9	.021	.087	......	
			Stem ends[19]	59.80	366.9	172.0	1,055.2	......	......	83.7	.072	.206	......	
27073[10]	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).	May 2.	Whole	1.40	9.3	4.8	32.0	......	......	85.0	.212	.729	......	151.8
			Pulp	.03	.2	.5	3.4	......	......	85.3	.004	.064	......	
	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray, all applications) (pressure, 200 lbs.).[20]	May 29, June 12, 26, July 8, Aug. 18.	Skin	5.60	30.8	17.6	96.7	......	......	81.8	.112	.352	......	
			Calyx	42.00	214.3	137.3	700.5	......	......	80.4	.046	.151	......	
			Stem ends	41.70	230.4	135.5	748.6	......	......	81.9	.050	.162	......	
			Skin[19]	2.30	12.6	7.6	41.8	......	......	81.8	.047	.152	......	
			Calyx[19]	42.00	214.3	137.3	700.5	......	......	80.4	.046	.151	......	
			Stem ends[19]	34.10	188.4	112.1	619.3	......	......	81.9	.041	.135	......	
26725[10]	1 lb. lead arsenate (powder), 50 galls. water (Bordeaux nozzle, very coarse spray) (pressure, 225 lbs.).	May 2.	Whole	1.80	12.2	6.1	41.2	......	......	85.2	.295	1.000	......	164.0
			Pulp	.10	.7	.5	3.5	......	......	85.8	.014	.070	......	
			Skin	6.70	38.3	24.4	139.4	......	......	82.5	.147	.537	......	
	1 lb. lead arsenate (powder), 50 galls. water (Friend nozzle, mist-like spray) (pressure, 200 lbs.).[20]	May 29, June 12, 26, July 8, Aug. 18.	Calyx	43.30	231.5	124.6	666.3	......	......	81.3	.052	.149	......	
			Stem ends	63.60	392.6	187.5	1157.4	......	......	83.8	.082	.244	......	
			Skin[19]	2.60	14.9	10.5	60.0	......	......	82.5	.057	.231	......	
			Calyx[19]	37.50	200.5	93.8	501.6	......	......	81.3	.045	.112	......	
			Stem ends[19]	63.60	392.6	187.5	1157.4	......	......	83.8	.082	.244	......	
26759[10]	10 per cent lead arsenate, 90 per cent terra alba (dust applications).[20]	May 6, June 2, July 8.	Whole	.10	.6	.7	4.2	......	......	83.4	.014	.100	......	142.2
			Pulp	.02	.1	.4	2.6	......	......	84.4	.002	.048	......	
			Skin	.15	.8	1.0	5.3	......	......	81.0	.003	.019	......	
			Calyx	3.10	14.1	10.4	47.3	......	......	78.0	.003	.010	......	
			Stem ends	5.00	29.1	19.0	110.5	......	......	82.8	.006	.023	......	
			Skin[19]	.15	.8	1.0	5.3	......	......	81.0	.003	.019	......	
			Calyx[19]	3.10	14.1	10.4	47.3	......	......	78.0	.003	.010	......	
			Stem ends[19]	5.00	29.1	19.0	110.5	......	......	82.8	.006	.023	......	
27074[10]	10 per cent lead arsenate, 90 per cent terra alba (dust applications).[20]	May 6, June 2, July 8, Aug. 18.	Whole	.30	2.0	1.2	7.9	......	......	84.8	.045	.180	......	150.0
			Pulp	.08	.5	.4	2.7	......	......	85.0	.010	.051	......	
			Skin	1.30	7.1	3.9	21.2	......	......	81.6	.026	.078	......	
			Calyx	4.20	20.0	20.5	97.6	......	......	79.0	.004	.023	......	
			Stem ends	4.70	27.0	23.4	134.5	......	......	82.6	.005	.028	......	
			Skin[19]	.60	3.3	2.1	11.4	......	......	81.6	.012	.042	......	
			Calyx[19]	2.20	10.5	12.5	59.5	......	......	79.0	.002	.014	......	
			Stem ends[19]	4.70	27.0	23.4	134.5	......	......	82.6	.005	.028	......	

26968[10]	10 per cent lead arsenate, 90 per cent terra alba (dust applications).[20]	May 6, June 2, 20, July 8, Aug. 18.	Whole	.30	1.8	1.2	7.2	......	......	83.4	.041	.164	......	136.9
			Pulp	.10	.6	.5	3.1	......	......	84.0	.012	.058	......	
			Skin	1.00	5.2	3.3	17.1	......	......	80.7	.019	.063	......	
			Calyx	4.80	21.4	19.0	84.8	......	......	77.6	.005	.019	......	
			Stem ends	5.00	27.3	24.2	132.2	......	......	81.7	.005	.024	......	
			Skin[19]	1.00	5.2	3.3	17.1	......	......	80.7	.019	.063	......	
			Calyx[19]	3.50	15.6	14.5	64.7	......	......	77.6	.004	.015	......	
			Stem ends[19]	5.00	27.3	24.2	132.2	......	......	81.7	.005	.024	......	
26726[10]	20 per cent lead arsenate, 80 per cent terra alba (dust applications.)[20]	May 6, June 2, July 8, Aug. 18.	Whole	.30	1.8	1.3	8.0	......	......	83.8	.039	.168	......	129.3
			Pulp	.04	.3	.5	3.2	......	......	84.4	.004	.054	......	
			Skin	1.10	5.8	3.4	17.9	......	......	81.0	.021	.064	......	
			Calyx	7.30	33.2	26.0	118.2	......	......	78.0	.007	.026	......	
			Stem ends	7.20	38.7	23.9	128.5	......	......	81.4	.007	.024	......	
			Skin[19]	1.10	5.8	3.4	17.9	......	......	81.0	.021	.064	......	
			Calyx[19]	5.00	22.7	20.0	90.9	......	......	78.0	.005	.020	......	
			Stem ends[19]	7.20	38.7	23.9	128.5	......	......	81.4	.007	.024	......	
26727[10]	Check plat (unsprayed)[20]	......	Whole	.04	.3	.5	3.4	......	......	85.5	.006	.074	......	148.9
		1917.												
28431[21]	1½ galls. lime-sulphur, 50 galls. water, 2 lbs. lead arsenate (paste).	Apr. 14, 26, May 17.	do	.05	.3	.7	4.6	1.7	11.1	84.7	.007	.100	0.243	143.0
			Pulp	.02	.1	.4	2.8	.6	4.2	85.6	.002	.048	.072	
			Skin	.10	.5	1.2	6.2	6.4	32.8	80.5	.002	.025	.131	
	Standard 4-4-50 Bordeaux[22]	June 2, 21, July 9, Aug. 2.	Calyx	2.80	14.6	18.5	96.4	18.5	96.4	80.8	.002	.018	.018	
			Stem ends	.60	3.8	6.2	38.8	15.7	98.1	84.0	.001	.009	.022	
			Skin[19]	.10	.5	1.2	6.2	4.4	22.6	80.5	.002	.025	.090	
			Calyx[19]	1.90	9.9	11.3	58.9	7.6	39.6	80.8	.002	.011	.008	
			Stem ends[19]	.60	3.8	6.2	38.8	11.7	73.1	84.0	.001	.009	.016	
28432[21]	1½ galls. lime-sulphur, 50 galls. water, 2 lbs. lead arsenate (paste).[22]	Apr. 14, 26, May 17.	Whole	.03	.2	.7	4.6	.5	3.3	85.0	.004	.100	.071	143.0
29096[10]	Check plat (unsprayed)[23]	......	do	.09	.5	.4	2.2	......	......	81.9	.008	.038	......	94.3
29097[10]	1 lb. lead arsenate (powder), 50 galls. water (Bean Clipper nozzle).	May 26.	do	1.40	8.4	4.5	26.9	......	......	83.3	.132	.425	......	94.6
			Pulp	.08	.5	.5	3.2	......	......	84.2	.006	.039	......	
	1 lb. lead arsenate (powder), 50 galls. water (Friend Whirlpool mist nozzle).[23]	June 13, 28, July 19, Aug. 24.	Skin	3.80	19.2	12.2	61.6	......	......	80.2	.056	.181	......	
			Calyx	52.50	259.9	154.0	762.4	......	......	79.8	.053	.154	......	
			Stem ends	17.00	97.1	51.0	291.4	......	......	82.5	.017	.051	......	
			Skin[19]	.30	1.5	3.9	19.7	......	......	80.2	.004	.058	......	
			Calyx[19]	19.70	97.5	52.6	260.4	......	......	79.8	.020	.053	......	
			Stem ends[19]	12.30	70.3	29.2	166.9	......	......	82.5	.012	.029	......	
29098[10]	1 lb. lead arsenate (powder), 50 galls. water (Bean Clipper nozzle).	May 26.	Whole	3.00	17.1	8.6	49.1	......	......	82.5	.269	.770	......	89.5
			Pulp	.20	1.3	.5	3.1	......	......	84.0	.014	.036	......	
	1 lb. lead arsenate (powder), 50 galls. water (Friend Whirlpool mist nozzle).[23]	June 13, 23, July 4, 19, Aug. 14, Sept. 4.	Skin	11.00	54.5	30.6	151.5	......	......	79.8	.162	.452	......	
			Calyx	53.30	243.4	161.1	735.6	......	......	78.1	.053	.161	......	
			Stem ends	40.20	216.1	121.6	653.8	......	......	81.4	.040	.121	......	
			Skin[19]	1.60	7.9	2.9	14.4	......	......	79.8	.024	.043	......	
			Calyx[19]	16.80	76.7	52.1	237.9	......	......	78.1	.017	.052	......	
			Stem ends[19]	15.80	84.9	48.8	262.4	......	......	81.4	.016	.049	......	

For footnote references see page 47.

TABLE 14.—*Arsenic, lead, and copper remaining on sprayed apples at picking time*—Continued.

Sample No.	Spray material used.	Date sprayed.	Determinations made on.	Arsenic (As). Original fruit.	Arsenic (As). Dried fruit.	Lead (Pb). Original fruit.	Lead (Pb). Dried fruit.	Copper (Cu). Original fruit.	Copper (Cu). Dried fruit.	Loss on drying.	Arsenic in apple (average).	Lead in apple (average).	Copper in apple (average).	Average weight, apple.
				Parts per million.						*Per ct.*	*Mg.*	*Mg.*	*Mg.*	*Grams.*
29099 [10]	1 lb. lead arsenate (powder), 50 galls. water (Friend Whirlpool mist nozzle).[23]	1917. June 13, 23, July 4, 19, Aug. 23.	Whole	1.90	10.6	6.1	33.9	....	....	82.0	0.171	0.547	....	89.8
			Pulp	.08	.5	.5	2.9	....	....	83.0	.006	.036	....	
			Skin	7.70	35.8	23.0	107.0	....	....	78.5	.114	.340	....	
			Calyx	21.90	95.2	68.6	298.3	....	....	77.0	.022	.069	....	
			Stem ends	29.50	159.4	102.2	552.4	....	....	81.5	.029	.102	....	
			Skin [19]	1.70	7.9	4.8	22.3	....	....	78.5	.025	.071	....	
			Calyx [19]	12.50	54.3	29.5	128.3	....	....	77.0	.013	.030	....	
			Stem ends [19]	17.70	95.7	53.5	289.2	....	....	81.5	.018	.054	....	
33375	1 lb. lead arsenate (powder), 3 lbs. atomic sulphur, 50 galls. water (pressure, 225-250 lbs.).[24]	1919. May 8-10.	Whole	1.40	9.6	5.2	36.0	....	....	85.4	.220	.810	....	154.0
			Pulp	.05	.4	.7	5.3	....	....	86.6	.005	.063	....	
			Skin	6.60	34.0	30.0	160.0	....	....	80.9	.110	.490	....	
			Calyx	34.00	170.0	93.0	480.0	....	....	80.5	.052	.140	....	
			Stem ends	24.00	140.0	81.0	470.0	....	....	82.6	.034	.120	....	
	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).[24]	May 29-31, June 18-20, July 21-24, Aug. 18-21.	Skin [3]	3.10	16.0	13.0	68.0	....	....	80.5	.049	.210	....	
			Calyx [3]	23.00	120.0	66.0	330.0	....	....	79.9	.040	.120	....	
			Stem ends [3]	11.00	66.0	39.0	230.0	....	....	82.9	.018	.063	....	
33376	¾ lb. calcium arsenate (powder), 2 lbs. lime, 2 lbs. flour, 50 galls. water (pressure, 200-225 lbs.).[24]	May 8-10.	Whole	.79	6.2	....	....	....	....	87.3	.150	....	....	183.0
			Pulp	.07	.6	....	....	....	....	88.0	.010	....	....	
			Skin	5.80	35.0	....	....	....	....	83.4	.110	....	....	
	¾ lb. calcium arsenate (powder), 2 lbs. lime, 2 lbs. flour, 50 galls. water (pressure, 225 lbs.).	May 29-31, June 18-20, July 21-24, Aug. 18-21.	Calyx	24.00	140.0	....	....	....	....	81.9	.031	....	....	
			Stem ends	27.00	170.0	....	....	....	....	83.5	.033	....	....	
			Skin [3]	1.10	6.5	....	....	....	....	82.8	.024	....	....	
			Calyx [3]	16.00	91.0	....	....	....	....	82.2	.022	....	....	
			Stem ends [3]	17.00	102.0	....	....	....	....	83.4	.017	....	....	
33377	1 lb. lead arsenate (powder), 3 lbs. atomic sulphur, 50 galls. water, Spreader No. 1[25] (pressure, 225-240 lbs.).[24]	May 8-10.	Whole	1.20	9.5	3.3	26.0	....	....	87.4	.240	.800	....	240.0
			Pulp	.07	.6	.6	6.0	....	....	89.0	.008	.075	....	
			Skin	8.80	54.0	26.0	160.0	....	....	83.6	.170	.050	....	
	1 lb. lead arsenate (powder), 50 galls. water, Spreader No. 1[25] (pressure, 225 lbs.).	May 29-31.	Calyx	35.00	220.0	104.0	630.0	....	....	83.6	.041	.120	....	
			Stem ends	44.00	300.0	115.0	790.0	....	....	85.2	.039	.096	....	
			Skin [3]	1.80	11.0	2.7	16.0	....	....	83.2	.038	.056	....	
			Calyx [3]	10.00	65.0	35.0	220.0	....	....	83.9	.012	.041	....	
	1 lb. lead arsenate (powder), 50 galls. water, Spreader No. 2 (pressure, 225 lbs.).[26]	June 18-20, July 21-24, Aug. 18-21.	Stem ends [3]	9.30	62.0	24.0	160.0	....	....	85.1	.009	.023	....	
33378	3 lbs. lead arsenate (powder), 3 lbs. atomic sulphur, 50 galls. water (pressure, 220-245 lbs.).[24]	May 8-10.	Whole	5.40	40.0	17.0	130.0	....	....	86.5	.900	2.800	....	166.0
			Pulp	.08	.6	1.8	15.0	....	....	87.4	.010	.230	....	
			Skin	22.00	130.0	75.0	430.0	....	....	82.7	.440	1.500	....	

	3 lbs. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).[24]	May 29-31, June 18-20, July 21-24, Aug. 18-21.	Calyx	127.00	760.0	328.0	2000.0	...	...	83.3	.150	.400	...	
			Stem ends	328.00	2000.0	421.0	2500.0	...	...	82.9	.310	.410	...	
			Skin[3]	7.60	44.0	28.0	160.0	...	...	83.0	.140	.530	...	
			Calyx[3]	83.00	470.0	297.0	1700.0	...	...	83.1	.065	.230	...	
			Stem ends[3]	68.00	390.0	252.0	1500.0	...	...	82.6	.058	.220	...	
33379	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225-250 lbs.).[24]	May 8-10.	Whole	3.70	26.0	15.0	110.0	...	...	86.1	.580	2.500	...	159.0
			Pulp	.11	.9	1.4	11.0	...	...	87.6	.014	.170	...	
	1 lb. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).[24]	May 29-31, June 11, 26.	Skin	15.00	91.0	80.0	480.0	...	...	83.6	.310	1.600	...	
			Calyx	49.00	300.0	120.0	750.0	...	...	83.8	.068	.180	...	
	3 lbs. lead arsenate (powder), 50 galls. water (pressure, 225 lbs.).[24]	July 21-24, Aug. 18-21.	Stem ends	210.00	1700.0	550.0	4400.0	...	...	87.6	.240	.630	...	
			Skin[3]	5.00	31.0	13.0	82.0	...	...	83.7	.100	.280	...	
			Calyx[3]	24.00	150.0	61.0	380.0	...	...	84.3	.030	.075	...	
			Stem ends[3]	76.00	600.0	190.0	1500.0	...	...	87.5	.075	.180	...	
33380	1½ lbs. magnesium arsenate (powder), 50 galls. water (pressure, 225-250 lbs.).	May 8-10.	Whole	.56	4.4	...	...	...	...	87.2	.100	...	...	179.0
			Pulp	.06	.4	...	...	...	...	88.2	.008	...	...	
	1½ lbs. magnesium arsenate (powder), 50 galls. water (pressure, 225 lbs.).[24]	May 29-31, June 18-20, July 21-24, Aug. 18-21.	Skin	3.50	21.0	...	...	...	...	83.4	.073	...	...	
			Calyx	21.00	130.0	...	...	...	...	82.8	.028	...	...	
			Stem ends	13.00	87.0	...	...	...	...	84.9	.016	...	...	
			Skin[3]	2.60	16.0	...	...	...	...	83.4	.058	...	...	
			Calyx[3]	21.00	130.0	...	...	...	...	84.6	.028	...	...	
			Stem ends[3]	8.60	60.0	...	...	...	...	85.9	.012	...	...	

---

[1] Rome Beauty.

[2] Harvested last of October, 1915, Moorestown, N. J.

[3] Fruit wiped with dry cloth before peeling.

[4] Jonathan.

[5] Harvested Aug. 26, 1915, Rosewell, N. Mex.

[6] Harvested Sept. 1, 1915, Rosewell, N. Mex.

[7] Harvested Sept. 10, 1915, Rosewell, N. Mex.

[8] Winesap.

[9] Harvested Sept. 20, 1915, Rosewell, N. Mex.

[10] Ben Davis.

[11] Harvested Oct. 16, 1915, Rosewell, N. Mex.

[12] Harvested Oct. 28, 1915, Benton Harbor, Mich.

[13] Harvested Oct. 10, 1915, Grand Junction, Colo.

[14] Harvested last of October, 1915, Grand Junction, Colo.

[15] Harvested Oct. 22, 1916, Moorestown, N. J.

[16] Fruit wiped with damp cloth before peeling.

[17] Harvested Oct. 2, 1916, Rosewell, N. Mex.

[18] Harvested Oct. 28, 1916, Benton Harbor, Mich.

[19] Fruit washed under tap water and wiped with dry towel before peeling.

[20] Harvested Nov. 1, 1916, Grand Junction, Colo.

[21] Albemarle Pippin.

[22] Harvested Sept. 14, 1917, Greenwood, Va.

[23] Harvested Oct. 29, 1917, Grand Junction, Colo.

[24] Harvested Oct. 15, 1919, Yakima, Wash.

[25] Spreader 1 made by thoroughly mixing 1½ parts of casein with 3½ parts of hydrated lime, 12 ounces of the mixture being worked into a paste with water and added to 200 gallons of spray mixture.

[26] Spreader 2 made by thoroughly mixing 1½ ounces of borax with 10 ounces of casein, the mixture thoroughly agitated with water, and used at the rate of half of this amount to a 200-gallon tank of spray mixture.

Several spray schedules are represented by the samples shown in Table 14. Very little spray residue was present on the apples, except Samples 23598, 33378, and 33379, which were purposely heavily sprayed, and the apples from Grand Junction, Colo. The 1915 samples from Grand Junction showed so much more residue than the apples from other districts that the spraying schedule was changed in 1916 and 1917, with the result that much less spray residue was found on the fruit.

TABLE 15.—*Arsenic, lead, and copper remaining on fruits and vegetables sprayed with poisonous sprays (summary).*

Product.	Determinations made on.	Arsenic (As).		Lead (Pb).		Copper (Cu).	
		Original basis.	Dry basis.	Original basis.	Dry basis.	Original basis.	Dry basis.
		Parts per million.					
Peaches:							
Sprayed	Whole	0.02– 0.94	0.10– 8.0	0.3– 2.6	2.0– 23.0		
	Pulp	.00– .14	.00– 1.2	.1– .8	.7– 5.6		
	Skin	.04– 4.50	.20– 35.4	.7– 12.2	4.4– 96.1		
Unsprayed	Whole	.00– .23	.00– 2.0	.0– .6	.0– 4.0		
	Pulp	.00– .10	.00– .9	.0– .4	.0– 2.8		
	Skin	.00– .77	.00– 6.1	.0– 1.7	.0– 11.9		
Cherries:							
Sprayed	Whole	.04– .35	.20– 2.3	.6– 1.3	2.8– 8.1	2.0– 3.2	11.9– 15.2
	Whole [1]	.02– .17	.10– 1.1	.4– 1.3	1.9– 8.1	1.2– 1.8	7.9– 10.6
Unsprayed	Whole	.02– .08	.16– .6	.6– .7	2.8– 5.3	.5– 1.4	4.0– 8.3
Plums:							
Sprayed	Whole	.03– .13	.20– .8	.2– .5	1.6– 3.1	.3– 1.2	2.4– 6.8
	Whole [1]	.02– .10	.20– .6	.2– .5	1.5– 2.9	.3– .9	2.4– 5.1
Unsprayed	Whole	.03– .10	.20– .6	.3– .4	2.2– 2.3	.5– .6	3.4– 3.7
	Whole [1]	.02– .07	.10– .4	.2– .3	1.4– 1.7	.4– .6	3.0– 3.4
Tomatoes:							
Sprayed	Whole	.07– .30	1.10– 5.2	.5– 1.7	7.6– 29.8	.8– 5.7	14.3– 91.9
	Pulp	.02– .05	.30– .9	.2– 1.2	3.3– 21.1	.5– 2.2	9.4– 35.5
Unsprayed	Whole	.02– .07	.40– 1.4	.3– .9	6.0– 16.1	.6– 1.8	10.5– 30.0
	Pulp	.02– .02	.40– .4	.2– .6	4.0– 10.7	.5– 1.2	8.8– 20.0
Celery:							
Sprayed	Leaves					4.7–258.1	33.6–2,150.8
	Stalks					.9– 16.6	11.5– 207.5
	Leaves [1]					2.1– 85.5	15.0– 712.5
	Stalks [1]					.7– 8.2	8.7– 102.5
Unsprayed	Whole					2.3–	24.2– ......
Cucumbers:							
Sprayed	Whole					1.2– 1.4	25.5– 28.6
	Pulp					.3– .3	6.8– 7.3
	Skin					2.5– 2.8	38.5– 44.4
Unsprayed	Whole					.6–	11.3– ......
	Pulp					.3–	7.1– ......
	Skin					.5–	7.7– ......
Cranberries:							
Sprayed	Whole	0.10– 3.90	0.80– 30.7	0.6– 19.1	4.9– 150.4	1.3– 33.3	10.6– 268.5
	Whole [1]	.09– 1.50	.70– 11.8	.6– 12.4	4.9– 97.7	1.0– 16.2	7.8– 130.6
Unsprayed	Whole	.01– .10	.08– .7	.4– .7	2.9– 5.6	.6– 1.0	4.8– 7.4
Grapes:							
Sprayed	Whole	.05– 7.10	.26– 35.5	.5– 17.6	2.5– 88.0	.6– 6.4	2.9– 33.8
	Whole [1]	.02– 4.40	.10– 24.0	.3– 12.0	1.5– 65.6	.3– 4.2	1.4– 22.2
Unsprayed	Whole	.00– .07	.00– .4	.5– 1.1	2.6– 6.8	.4– .9	2.1– 4.7
Pears:							
Sprayed	Whole	.10– .32	.50– 2.1	.3– 1.0	1.6– 6.7	1.5– 3.0	10.0– 14.5
	Pulp	.02– .10	.10– .8	.2– .2	1.0– 1.7	.7– 1.0	4.9– 5.1
	Skin	.30– 1.00	1.20– 4.3	.8– 3.2	3.1– 13.7	4.5– 16.2	19.3– 54.5
	Calyx	1.20– 6.40	4.80– 27.7	4.2– 21.3	16.7– 92.2	12.1– 21.9	52.4– 68.9
	Skin [2]	.30– .90	1.20– 4.0	.8– 3.0	3.1– 13.4	2.1– 12.4	9.0– 41.8
	Calyx [2]	1.20– 6.40	4.80– 27.7	4.2– 21.3	16.7– 92.2	7.8– 8.2	25.8– 33.8
Unsprayed	Whole	.05– .10	.30– .6	.2– .3	1.0– 1.5	.3– .9	1.7– 4.5
Apples:							
Sprayed	Whole	.03– 5.50	.20– 40.0	.3– 17.0	2.2– 130.0	.4– 5.2	2.4– 24.2
	Pulp	.02– .40	.10– 2.5	.2– 1.8	1.3– 15.0	.3– .8	1.8– 4.2
	Skin	.10– 25.70	.50– 130.0	.7– 80.0	3.3– 480.0	.6– 28.5	2.8– 111.3
	Calyx	.70–127.00	3.50– 760.0	2.2–328.0	11.6–2,000.0	2.5– 29.5	12.4– 149.0
	Stem ends	.40–328.00	2.70–2,000.0	2.8–550.0	17.7–4,400.0	2.7– 29.4	15.3– 136.1
	Skin [2]	.10– 22.70	.50– 92.3	.5– 63.0	2.4– 256.1	.6– 28.5	2.8– 111.3
	Calyx [2]	.70– 83.00	3.50– 470.0	2.2–297.0	11.6–1,700.0	2.5– 14.7	12.4– 74.2
	Stem ends [2]	.40– 76.00	2.70– 600.0	2.8–252.0	17.7–1,500.0	2.7– 21.2	15.3– 98.1
Unsprayed	Whole	.04– .44	.2 – 2.2	.2– 1.5	1.3– 9.3	.3– .7	2.3– 4.3

TABLE 15.—*Arsenic, lead, and copper remaining on fruits and vegetables sprayed with poisonous sprays (summary)*—Continued.

Product.	Determination made on.	Arsenic in each fruit.		Lead in each fruit.		Copper in each fruit.	
		Mg.	*Grains.*	*Mg.*	*Grains.*	*Mg.*	*Grains.*
Peaches:							
Sprayed..	Whole...	0.002–0.115	0.000031–0.00180	0.024–0.297	0.00037–0.00460	....	....
	Pulp....	.000– .014	.000000– .00022	.007– .062	.00011– .00095	....	....
	Skin....	.001– .101	.000015– .00160	.013– .284	.00020– .00440	....	....
Unsprayed.	Whole...	.000– .026	.000000– .00040	.000– .057	.00000– .00088	....	....
	Pulp....	.000– .009	.000000– .00014	.000– .032	.00000– .00049	....	....
	Skin.....	.000– .017	.000000– .00026	.000– .033	.00000– .00051	....	....
Pears:							
Sprayed..	Whole...	.013– .049	.000200– .00075	.039– .151	.000600– .00230	0.227–0.411	0.003500–0.00630
	Pulp....	.003– .010	.000046– .00015	.015– .029	.000230– .00045	.095– .120	.001500– .00180
	Skin....	.005– .023	.000077– .00035	.012– .073	.000180– .00110	.102– .261	.001600– .00400
	Calyx...	.002– .016	.000031– .00025	.005– .053	.000077– .00082	.030– .030	.000460– .00046
	Skin [2]...	.005– .014	.000077– .00022	.012– .054	.000180– .00083	.049– .200	.000750– .00310
	Calyx [2].	.002– .016	.000031– .00025	.005– .053	.000077– .00082	.011– .020	.000170– .00031
Unsprayed.	Whole...	.006– .013	.000092– .00020	.022– .037	.000340– .00057	.033– .113	.000510– .00170
Apples:							
Sprayed..	Whole...	.004– .900	.000062– .01400	.036–2.800	.000550– .04300	.054– .380	.000830– .00590
	Pulp....	.002– .042	.000031– .00035	.015– .230	.000230– .00350	.035– .072	.000540– .00110
	Skin....	.002– .442	.000031– .00680	.010–1.600	.000150– .02500	.010– .273	.000150– .00420
	Calyx...	.001– .154	.000015– .00240	.003– .400	.000046– .00620	.003– .032	.000046– .00049
	Stem ends..	.001– .310	.000015– .00480	.003– .768	.000046– .01200	.003– .035	.000046– .00054
	Skin [2]...	.002– .345	.000031– .00530	.007– .958	.000110– .01500	.010– .273	.000150– .00420
	Calyx [2]..	.001– .127	.000015– .00200	.003– .332	.000046– .00510	.003– .016	.000046– .00025
	Stem ends [2].	.001– .170	.000015– .00260	.003– .524	.000046– .00810	.003– .025	.000046– .00039
Unsprayed.	Whole..	.005– .051	.000077– .00079	.019– .178	.000290– .00270	.024– .093	.000370– .00140

[1] Washed.

[2] Wiped.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested.*

BERLIN, MD., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1915.	*Inches.*	1915.	*Inches.*	1915.	*Inches.*	1915.	*Inches.*
May 3....	Trace	June 1....	0.02	July 2....	0.58	Aug. 6....	.35
4....	0.08	2....	1.75	4....	.72	8....	.20
5....	.33	3....	1.20	5....	.80	9....	.25
12....	.63	5....	.01	8....	.07	10....	.20
13....	Trace.	6....	.08	11....	.57	12....	.28
15....	Trace.	12....	.07	13....	.58	14....	.04
16....	.44	13....	.13	17....	.48	21....	.01
17....	Trace.	14....	.05	20....	2.20	22....	.01
20....	.02	16....	.02	21....	.10	27....	Trace.
21....	.20	17....	.70			28....	.53
24....	.67	18....	Trace.		6.10	29....	.01
26....	.22	19....	.58		[1] 3.17	30....	.11
29....	.47	22....	.01				
30....	.32	27....	.22	Aug. 1.....	Trace.		3.94
		30....	Trace.	2....	0.15		[1] 5.12
	3.38			3....	.60		
	[1] 3.26		4.84	4....	1.20		
			[1] 3.84	5....	Trace.		

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

SPRINGFIELD, W. VA., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1915.	*Inches.*	1915.	*Inches.*	1916.	*Inches.*	1916.	*Inches.*
May 3	0.21	June 1	Trace.	May 2	0.06	June 3	0.38
7	.15	2	1.46	3	.13	7	.30
12	.75	3	.05	4	.07	8	.31
16	1.05	7	.21	7	.38	9	.20
17	.20	11	Trace.	8	Trace.	10	.27
20	.21	13	.37	13	Trace.	15	.32
21	.03	14	.34	16	1.02	16	1.36
22	.57	16	.06	23	.42	19	.12
24	Trace.	22	.06	26	.13	21	.31
29	.42	26	.06	29	.30	25	.30
30	.67	30	.35	30	.50		
31	.05						3.87
			2.96		3.01		[1] 3.86
	4.31		[1] 3.86		[1] 3.69		
	[1] 3.69					Aug. 3	.32
		Aug. 1	.10	July 2	.31	6	1.05
July 4	.35	2	1.05	10	.23	7	Trace.
5	.13	3	1.10	12	.05	8	.10
8	.17	8	.30	13	.15	11	.11
11	.79	9	.18	14	.20	13	.34
12	.14	11	.15	16	.32	15	.14
15	.07	12	.13	17	.21	21	Trace.
16	.05	17	.40	18	.23	22	Trace.
19	Trace.	21	.42	21	.40	28	.60
20	.15	27	Trace.	25	.60		
21	.08	28	1.75				2.66
22	Trace.				2.70		[1] 3.88
25	.75		5.58		[1] 3.57		
29	.64		[1] 3.88				
	3.32						
	[1] 3.57						

FORT VALLEY, GA., SECTION.

1917.		1917.		1917.		1917.	
Apr. 2	0.62	May 12	Trace.	June 25	Trace.	July 14	Trace.
4	Trace.	23	.82	26	Trace.	16	.18
5	2.23	25	Trace.	27	Trace.	17	Trace.
8	.33	28	.63	29	.20	18	.53
13	Trace.			30	.10	19	.23
14	.23		2.91			20	1.03
22	Trace.		[1] 3.11		1.34	21	.10
26	Trace.				[1] 4.21	22	Trace.
		June 4	Trace.			23	Trace.
	3.41	10	Trace.	July 4	0.96	24	1.56
	[1] 4.28	14	0.10	5	.10	25	Trace.
		15	.50	6	Trace.	26	.10
May 4	0.30	22	Trace.	7	Trace.	27	Trace.
5	.61	23	0.44	8	Trace.		
7	.45	24	Trace.	12	Trace.		4.79
8	0.10						[1] 5.87
11	Trace.						

WENATCHEE, WASH., SECTION.

1916.		1916.		1916.		1916.	
May 5	0.09	May 31	0.04	June 24	0.06	July 2	0.99
6	.02			25	Trace.	8	Trace.
7	Trace.		.32	26	.17	15	Trace.
8	.10		[1] .86	27	.22	16	.52
9	Trace.			28	.06	27	Trace.
16	.01	June 3	Trace.	29	Trace.		
20	Trace.	18	Trace.	30	.04		1.51
24	Trace.	20	.17				[1] .38
29	.01	22	Trace.		1.04		
30	.05	23	.32		[1] .96		

---

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

HART, MICH., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1916.	*Inches.*	1916.	*Inches.*	1916.	*Inches.*	1916.	*Inches.*
May 1	0.75	June 8	0.72	July 31	Trace.	Sept. 7	0.65
3	Trace.	9	.28			12	.05
6	.15	14	.95		3.26	13	.14
8	.27	17	.45		[1] 2.92	14	Trace.
10	1.27	18	.04			15	.04
14	.30	23	.25	Aug. 3	.85	16	.18
15	.18	26	Trace.	4	.13	17	.14
17	.06	30	.97	5	.53	21	.17
22	.28			6	.10	22	.07
25	.05		4.94	10	.16	26	.16
27	.07		[1] 2.39	13	.10	27	.40
29	.45			26	.38	28	.14
		July 8	Trace.	30	.25		
	3.83	13	.15				3.11
	[1] 3.76	16	2.27		2.50		[1] 3.00
		20	.53		[1] 2.42		
June 2	.70	22	.04				
7	.58	25	.27	Sept. 5	.97		

CAMDEN, N. J., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1915.		1915.		1915.		1915.	
July 1	0.19	July 21	0.20	Aug. 7	Trace.	Sept. 7	Trace.
2	.53	23	Trace.	8	1.05	12	0.08
3	Trace.	26	Trace.	9	.20	17	.29
4	.08	27	.28	12	.53	18	Trace.
5	Trace.	29	1.00	13	.01	19	.09
7	Trace.	30	.01	15	.05	21	.40
8	.67			17	Trace.	26	Trace.
11	Trace.		4.62	21	Trace.		
12	.64		[1] 4.30	25	.07		.86
14	.35			28	.03		[1] 3.74
15	Trace.	Aug. 1	.13	29	1.05		
16	.27	2	.02	30	.74		
17	.15	3	.32				
18	Trace.	4	2.10		6.61		
19	.25	5	Trace.		[1] 4.59		
20	Trace.	6	.31				

ARLINGTON, VA., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1916.		1916.		1916.		1916.	
July 2	0.01	Aug. 4	0.13	Sept. 6	0.06	Oct. 6	Trace.
3	Trace.	6	1.46	7	Trace.	9	0.03
9	.34	8	.17	8	.31	10	.01
10	.73	9	Trace.	9	Trace.	13	.09
15	.04	13	.19	14	Trace.	15	.02
16	Trace.	16	.30	15	1.17	16	.04
17	.03	23	.05	18	.18	17	Trace.
19	.09	27	.45	22	.46	18	.05
20	Trace.	28	.08	23	Trace.	19	1.24
22	1.67	30	Trace.	29	.38	20	.02
24	.15					31	.26
25	1.85		2.83		2.57		
26	.02		[1] 4.40		[1] 3.59		1.76
28	.04						[1] 3.09
		Sept. 2	.01	Oct. 5	Trace.		
	4.97						
	[1] 4.65						

SALEM, N. J., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1916.		1916.		1916.		1916.	
July 10	1.60	Aug. 1	0.05	Sept. 2	Trace.	Sept. 19	0.20
13	.34	8	.30	6	0.20	29	.52
20	.48	11	.18	7	.22		
21	.02	13	Trace.	8	.37		1.83
22	1.80	14	.08	15	.32		[1] 3.81
23	.05	27	.42				
25	.90	28	.20				
26	.05						
			1.23				
	5.24		[1] 4.74				
	[1] 4.43						

---

[1] Normal.

Table 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

NORTH LIBERTY, IND., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1915.	*Inches.*	1915.	*Inches.*	1915.	*Inches.*	1917.	*Inches.*
Aug. 2	0.70	Sept. 7	0.01	Oct. 17	0.03	Oct. 4	Trace.
3	.23	10	.22	18	.10	5	0.13
4	.05	11	.02			10	.15
5	.01	12	Trace.		1.86	11	.11
6	.02	16	.74		[1] 2.42	12	.06
11	.40	17	.35	1917.		13	Trace.
12	1.49	18	.32	Sept. 2	.04	14	.03
13	.04	20	.54	5	Trace.	17	1.23
16	.08	26	1.12	6	.69	18	1.20
17	Trace.	27	.09	7	.55	19	.29
20	.09			8	Trace.	21	.07
21	1.31		4.21	14	.05	23	.38
24	.12		[1] 3.03	20	.10	26	.63
		Oct. 1	.10	27	.04	27	.14
	4.54	4	.56			29	.68
	[1] 3.26	8	.13		1.47	30	.06
Sept. 4	Trace.	9	.40		[1] 3.03	31	Trace.
5	.25	13	.54	Oct. 3	.15		
6	.55						5.31
							[1] 2.42

PLYMOUTH, IND., SECTION.

1916.		1916.		1916.		1916.	
July 2	Trace.	Aug. 7	0.15	Sept. 1	Trace.	Sept. 26	0.02
12	0.05	10	.04	4	0.19	27	1.73
13	.51	11	1.55	5	2.01	28	.18
14	.02	15	Trace.	6	1.09		
19	.41	16	.02	13	Trace.		5.22
		18	.27	17	Trace.		[1] 3.27
	.99	27	.32				
	[1] 3.38						
			2.73				
Aug. 4	.38		[1] 3.49				

EAST WAREHAM, MASS., SECTION.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1916.		1916.		1916.		1917.	
June 4	0.40	Aug. 8	0.47	Oct. 21	0.39	Aug. 3	0.06
8	.18	9	.24	26	.27	5	.03
9	.96	10	.60			9	.07
10	.27	12	.17		2.85	10	.43
11	.19	13	.29		[1] 4.18	16	.38
12	.67	24	Trace.			17	.95
13	.18	26	Trace.	1917.		21	.10
17	.68	27	.20	June 2	.08	23	.07
18	.27	28	.22	6	.28	24	.03
19	Trace.			11	2.00	25	.44
22	.35		2.19	12	1.42	29	.04
26	.65		[1] 3.26	13	.05	30	.70
29	.37			16	.62		
		Sept. 2	.12	17	1.69		3.30
	5.17	6	.71	24	.23		[1] 3.26
	[1] 2.68	7	Trace.	27	.15		
		9	.12	29	.13	Sept. 8	.18
July 3	.78	15	.50			18	1.87
4	.08	16	.07		6.65	20	.24
5	.12	19	.10		[1] 2.68	24	.02
10	1.33	23	.13			28	.44
14	.52	25	.05	July 1	Trace.	30	.10
17	.15	30	.67	4	.52		
18	.10			12	.22		2.85
21	.78		2.47	13	Trace.		[1] 3.56
23	4.13		[1] 3.56	15	.08		
24	.15			19	.18	Oct.	[2] 5.02
26	.49	Oct. 9	.09	27	1.23		[1] 4.18
27	.16	13	.27				
31	.21	17	.11		2.23		
		18	Trace.		[1] 3.10		
	9.00	20	1.72				
	[1] 3.10						

---

[1] Normal.

[2] Total; daily data not reported.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

NORTH EAST, PA., SECTION.

Date.	Precipitation.
1915.	*Inches.*
July 1	Trace.
2	0.03
3	.65
4	.12
5	.19
7	.19
8	1.24
11	.81
12	.86
15	.13
16	.18
17	.04
19	.08
21	.09
25	.19
26	.02
28	.32
30	Trace.
31	Trace.
	5.14
	[1] 3.21
Aug. 2	Trace.
3	5.40
4	.38
5	.19
7	.02
8	.01
9	.04
11	Trace.
12	.66
13	.29
14	.07
15	.24
17	.04
20	.02
21	.54
1915.	*Inches.*
Aug. 22	0.33
24	.81
28	.21
29	.03
30	Trace.
	9.28
	[1] 3.26
Sept. 4	Trace.
5	.05
6	.36
8	.07
10	.01
12	.31
13	.50
15	1.49
17	.15
18	.55
19	Trace.
21	.11
24	.01
26	.58
	4.19
	[1] 3.49
Oct. 1	.38
2	.04
4	Trace.
5	.10
6	Trace.
7	Trace.
8	.20
9	.28
13	Trace.
14	1.04
15	Trace.
1915.	*Inches.*
Oct. 18	0.15
19	.02
21	Trace.
28	Trace.
29	Trace.
	2.21
	[1] 3.80
1916.	
July 2	.32
3	Trace.
4	Trace.
13	.02
16	.01
18	Trace.
19	Trace.
20	Trace.
25	Trace.
31	.04
	.39
	[1] 3.21
Aug. 3	Trace.
4	.03
5	.54
8	.71
11	Trace.
13	.49
16	Trace.
22	.17
23	Trace.
26	Trace.
27	.75
	2.69
	[1] 3.26
1916.	*Inches.*
Sept. 1	0.16
4	.11
5	.16
7	1.61
8	.81
14	.32
15	.01
16	.01
17	.06
18	.01
21	.13
22	.18
23	.16
26	Trace.
28	.59
29	.15
	4.47
	[1] 3.49
Oct. 9	.17
13	1.00
16	.23
17	.05
19	.67
20	.26
21	.07
22	.08
25	.08
26	.06
27	.01
31	.20
	2.88
	[1] 3.80

SANDUSKY, OHIO, SECTION.

Date.	Precipitation.
1916.	
June 2	0.43
3	.12
4	.29
6	.28
7	.72
8	.01
9	.34
10	.28
16	.81
17	Trace.
18	.25
19	.01
20	Trace.
21	.57
24	.17
26	Trace.
30	.08
	4.36
	[1] 3.82
July 2	.03
12	Trace.
13	.11
20	.12
	.26
	[1] 3.79
1916.	
Aug. 3	Trace.
4	0.03
5	.02
8	.48
11	.81
16	.15
19	Trace.
22	.67
27	.12
	2.28
	[1] 3.37
Sept. 2	Trace.
4	Trace.
5	Trace.
7	.63
8	.12
14	.05
17	Trace.
21	.01
22	.03
23	Trace.
26	.20
27	.09
28	.90
	2.03
	[1] 2.68
1916.	
Oct. 8	0.07
9	.11
12	Trace.
13	.28
16	.07
18	.11
19	.42
20	.15
21	Trace.
24	Trace.
25	.01
27	Trace.
31	.02
	1.24
	[1] 2.43
1917.	
June 2	.07
5	2.33
6	.66
9	.08
10	Trace.
12	Trace.
13	.14
14	Trace.
15	.28
16	.01
17	Trace.
1917.	
June 19	0.11
21	Trace.
22	.12
23	.22
26	Trace.
28	.18
29	.01
	4.21
	[1] 3.82
July 7	.08
9	.01
10	Trace.
11	.03
12	.08
13	.09
14	Trace.
16	.12
17	Trace.
21	.05
26	Trace.
	.46
	[1] 3.79
Aug. 2	.01
5	.20
7	.12

---

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested.*—Continued.

SANDUSKY, OHIO, SECTION—Continued.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1917.	*Inches.*	1917.	*Inches.*	1917.	*Inches.*	1917.	*Inches.*
Aug. 8	0.07	Sept. 2	0.02	Oct. 2	0.03	Oct. 27	.24
9	Trace.	5	.03	3	.67	28	0.44
13	.54	6	.73	4	.08	29	1.19
16	.38	7	.23	5	.05	30	.06
20	Trace.	20	Trace.	7	Trace.	31	.03
21	.01	27	1.31	8	Trace.		
22	.03	29	.02	11	.02		6.22
23	1.79	30	Trace.	12	.72		[1]2.43
25	Trace.			14	Trace.		
27	Trace.		2.34	17	Trace.		
28	.50		[1]2.68	18	.63		
29	.30			19	.85		
30	.04			22	.04		
				23	.54		
	3.99			24	Trace.		
	[1]3.37			26	.18		

MOORESTOWN AND BROWN MILLS, N. J., SECTIONS.

1915.		1915.		1915.		1916.	
Apr. 3	0.69	July 1	0.03	Oct. 15	0.14	July 10	0.90
4	.17	2	.37	16	.20	14	1.33
6	.03	5	.40	27	.40	15	.05
11	.73	8	1.04			17	.43
21	Trace.	12	.73		2.37	20	.05
23	Trace.	14	.53		[1]3.64	21	.52
27	.07	16	.97			22	.51
28	.10	17	.33	1916.		23	.05
29	.55	19	.35	May 4	.03	25	1.28
30	.50	21	.10	5	.39	26	.30
		27	.33	7	.21		
	2.84	29	.64	9	.43		5.42
	[1]3.19	31	.06	14	Trace.		[1]4.58
				16	.35		
May 4	.39		5.88	17	.19	Aug. 8	.67
5	.69		[1]4.58	18	.03	12	.38
9	.64			23	.59	16	Trace.
12	.36	Aug. 1	.19	24	.02	24	.09
13	.42	3	.27	25	1.05	28	.43
16	.07	4	2.11	29	.03		
17	.26	6	.21				1.57
21	.70	8	.20		3.32		[1]4.74
22	1.50	9	.37		[1]4.03		
23	.15	12	.47			Sept. 6	Trace.
24	.17	15	04	June 4	.10	7	.05
25	.02	25	.04	5	.17	8	.48
26	.06	28	Trace.	7	1.40	15	.36
30	.34	29	1.05	8	.15	19	.13
		30	.80	13	.42	29	.68
	5.77			16	.14	30	.11
	[1]4.03		5.75	17	.06		
			[1]4.74	19	.23		1.81
June 2	.63			20	.40		[1]3.76
3	.14	Sept. 12	.06	21	.26		
4	.04	18	.12	25	.45	Oct. 13	.20
12	.14	19	.13			19	.85
13	1.55	21	.38		3.78		
15	.44	26	Trace.		[1]3.80		1.05
16	.43						[1]3.64
17	.03		.69				
22	.45		[1]3.76				
23	.17						
26	.09	Oct. 1	.44				
28	Trace.	2	.26				
		5	.28				
	4.11	7	Trace.				
	[1]3.80	8	.65				
		14	Trace.				

---

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

ROSEWELL, N. MEX., SECTION.

Date.	Precipitation.
1915.	*Inches.*
Apr. 1	Trace.
6	0.01
7	.06
8	Trace.
9	Trace.
10	.17
13	.27
14	.01
15	1.44
16	3.48
17	.23
18	.01
19	.02
21	Trace.
22	Trace.
23	Trace.
24	.09
25	.02
29	.23
	6.04
	[1] .49
May 5	.04
23	.93
26	Trace.
27	.01
30	.02
31	.18
	1.18
	[1] 1.17
June 9	.06
10	.01
15	Trace.
23	.06
25	.01
26	Trace.
27	Trace.
	.14
	[1] 2.08
1915.	*Inches.*
July 3	Trace.
5	Trace.
8	Trace.
11	0.04
19	.12
20	.13
21	.01
23	.01
24	.02
25	.01
26	Trace.
27	.10
28	.01
	.45
	[1] 3.46
Aug. 7	Trace.
8	.28
9	.03
11	.23
12	.01
14	.48
18	.01
19	.08
20	.01
21	Trace.
22	Trace.
23	.52
27	.09
29	.03
	1.77
	[1] 1.46
Sept. 2	.09
4	.01
14	.01
16	.08
18	.01
21	.03
22	.22
23	.01
24	.73
1915.	*Inches.*
Sept. 25	0.39
29	.71
	2.29
	[1] 2.29
Oct. 5	.09
11	.01
14	Trace.
15	.02
	.12
	[1] 1.52
1916.	
Apr. 12	.07
13	.36
14	.24
25	.02
26	.39
30	.03
	1.11
	[1] .49
May 1	.17
	[1] 1.17
June 8	Trace.
12	.44
19	Trace.
24	Trace.
	.44
	[1] 2.08
July 4	Trace.
6	.68
7	.05
11	Trace.
12	.04
17	Trace.
18	.01
19	.15
1916.	*Inches.*
July 20	Trace.
27	0.01
28	.02
29	.08
	1.04
	[1] 3.46
Aug. 7	1.00
8	4.57
16	.27
17	.32
18	.06
19	1.07
20	.30
21	.01
22	.52
23	1.39
27	.05
30	Trace.
	9.56
	[1] 1.46
Sept. 2	.01
4	Trace.
10	Trace.
12	.30
19	.06
30	Trace.
	.37
	[1] 2.29
Oct. 10	.14
11	.37
12	.76
13	.76
14	.22
16	.01
27	.05
	2.31
	[1] 1.52

BENTON HARBOR, MICH., SECTION.

Date.	Precipitation.
1915.	
May 2	Trace.
3	0.60
4	Trace.
6	Trace.
7	.15
8	.45
13	.50
14	Trace.
15	.22
16	.32
17	Trace.
20	Trace.
21	.30
24	.50
25	.10
26	Trace.
28	.90
29	.60
30	.20
	4.84
	[1] 3.89
1915.	
June 7	0.09
8	Trace.
9	Trace.
10	.24
11	.12
12	Trace.
13	.47
14	.08
15	.07
16	Trace.
17	.04
18	.08
20	.25
21	.02
	1.46
	[1] 2.95
July 4	.63
7	1.20
8	.90
11	.20
14	1.17
1915.	
July 15	0.30
18	.80
20	Trace.
24	.23
25	.10
27	.17
28	.15
29	.20
30	.30
31	.18
	6.53
	[1] 2.52
Aug. 2	1.21
3	1.65
4	.25
5	.20
7	.55
8	Trace
11	.20
12	.17
13	.16
1915.	
Aug. 16	Trace.
21	0.61
24	.21
	5.21
	[1] 2.28
Sept. 5	.20
6	1.12
7	.06
10	.19
12	.70
15	Trace.
16	.40
17	.40
18	.60
20	1.15
21	Trace.
26	1.23
27	Trace.
	6.05
	[1] 3.06

---

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

BENTON HARBOR, MICH., SECTION—Continued.

Date.	Precipitation.
1915.	*Inches.*
Oct. 4	0.30
7	Trace.
8	.70
9	Trace.
13	.25
17	.30
18	.22
19	.20
	1.97
	[1] 2.76
1916.	
May 6	.10
8	.18
10	.50
13	.40
14	.57
15	.70
19	.70
21	.30
22	.70
26	.70
28	.80
1916.	*Inches.*
May 29	1.06
30	.30
	7.01
	[1] 3.89
June 2	.23
3	.03
6	.10
7	1.05
8	.49
9	.04
14	.61
16	.06
18	.05
20	.02
21	.37
23	.12
24	.27
26	.52
30	.05
	4.01
	[1] 2.95
1916.	*Inches.*
July 16	0.12
28	.39
	.51
	[1] 2.52
Aug. 3	.80
5	.53
8	Trace.
10	.69
11	.50
24	Trace.
26	.20
28	.20
	2.92
	[1] 2.28
Sept. 4	.20
5	1.20
7	.20
12	.02
1916.	*Inches.*
Sept. 13	0.30
22	.40
26	.04
27	.68
28	.15
29	.38
	3.57
	[1] 3.06
Oct. 9	.15
13	.10
15	Trace.
20	1.25
21	.45
25	.12
26	Trace.
29	Trace.
	2.07
	[1] 2.76

GRAND JUNCTION, COLO., SECTION.

Date.	Precipitation.
1915.	
May	[2] 1.23
	[2] .92
June 1	.20
3	.03
4	.08
5	.40
6	.19
9	Trace.
18	.02
28	Trace.
	.92
	[1] .40
July 5	.02
12	Trace.
26	.01
27	Trace.
28	Trace.
29	.13
	.16
	[1] .50
Aug. 5	Trace.
6	Trace.
7	.25
11	Trace.
14	Trace.
15	.05
16	Trace.
22	.01
23	.09
24	.09
25	.01
26	.01
29	Trace.
	.51
	[1] 1.04
1915.	
Sept. 2	Trace.
3	0.05
4	.04
7	Trace.
8	.02
13	Trace.
24	.03
25	.81
	.95
	[1] .95
Oct. 14	Trace.
15	.01
	.01
	[1] .91
1916.	
May 2	Trace.
13	Trace.
18	Trace.
19	.26
20	.78
21	.01
22	Trace.
	1.05
	[1] .92
June 5	Trace.
18	Trace.
	Trace.
	[1] .40
July 5	Trace.
6	Trace.
8	.20
9	Trace.
14	.01
15	.01
1916.	
July 16	Trace.
17	Trace.
20	Trace.
23	Trace.
24	Trace.
25	.33
26	.07
27	.11
28	.01
29	.02
30	Trace.
	.76
	[1] .50
Aug. 3	.73
4	Trace.
5	.10
6	.13
8	Trace.
9	Trace.
12	.60
13	.25
15	Trace.
16	.26
20	Trace.
29	.08
30	.01
	2.16
	[1] 1.04
Sept. 2	Trace.
5	.21
8	.01
9	.27
17	Trace.
22	.01
23	Trace.
	.50
	[1] .95
1916.	
Oct. 1	0.08
3	.10
4	.27
5	.06
6	.05
7	.51
9	Trace.
10	.51
11	.03
14	.37
15	.06
18	.08
	2.12
	[1] .91
1917.	
May 1	Trace.
2	.02
4	.01
5	.18
7	.01
8	Trace.
9	Trace.
12	.12
15	.04
20	.07
21	.11
22	.24
23	.01
25	.04
26	.03
27	.01
28	.01
29	.08
30	.15
31	.32
	1.45
	[1] .92

---

[1] Normal.

TABLE 16.—*Precipitation reports for sections where samples analyzed were harvested*—Continued.

GRAND JUNCTION, COLO., SECTION—Continued.

Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.	Date.	Precipitation.
1917.	*Inches.*	1917.	*Inches.*	1917.	*Inches.*	1917.	*Inches.*
June 1	Trace.	July 28	Trace.	Aug. 26	0.01	Sept. 12	0.15
4	0.01	29	0.07	27	Trace.	22	.10
10	Trace.	30	.21	28	.03	23	.02
21	Trace.			31	Trace.	25	.02
			.28			30	Trace.
	.01		[1] .50		.38		
	[1] .40				[1] 1.04		1.00
		Aug. 4	Trace.				[1] .95
July 5	Trace.	9	Trace.	Sept. 2	Trace.		
6	Trace.	10	.09	4	.01	Oct. 1	Trace.
10	Trace.	12	.02	5	Trace.	17	Trace.
20	Trace.	13	.22	6	.04	24	Trace.
24	Trace.	14	Trace.	8	.01		
25	Trace.	17	Trace.	9	.01		Trace.
26	Trace.	18	.01	10	.64		[1] .91

GREENWOOD, VA., SECTION.

1917.		1917.		1917.		1917.	
Apr. 5	2.33	June 1	0.43	July 16	0.16	Sept. 2	0.05
8	.30	2	.27	17	.14	6	.23
13	.44	5	.03	18	.01	7	.58
18	Trace.	9	1.40	21	.05	8	.36
21	.08	10	.22	22	.07	9	.04
24	.05	11	.03	24	.35	15	.19
25	.12	12	.01	25	.48	16	.05
27	.06	14	.38	26	.10	21	.01
28	.43	15	.01			27	.77
		20	.12		3.78		
	3.81	23	.64		[1] 4.89		2.28
	[1] 3.22	25	.18				[1] 4.18
		26	.02	Aug. 2	.46		
May 1	.03	27	.38	7	.01		
4	.78	28	1.37	8	1.08		
7	.38			9	2.21		
8	.13		5.49	14	.01		
11	Trace.		[1] 5.48	15	Trace.		
22	.02			16	.13		
26	Trace.	July 2	.36	23	2.80		
27	.65	3	.07	24	.73		
28	.68	7	.28	30	.60		
		8	.81	31	.08		
	2.67	10	.75				
	[1] 4.62	11	.13		8.11		
		14	.02		[1] 5.00		
		15	Trace.				

YAKIMA, WASH., SECTION.

1919.		1919.		1919.		1919.	
May 4	0.04	July 5	Trace.	Sept. 4	Trace.	Oct. 1	0.12
5	.18	6	Trace.	5	0.05	17	Trace.
11	Trace.	10	.03	6	.01	21	Trace.
15	.03	11	Trace.	8	.09	22	Trace.
16	Trace.	23	Trace.	10	Trace.	23	Trace.
25	.33	31	Trace.	11	.44	26	Trace.
				12	.01	31	Trace.
	.58		.03	27	.02		
	[1] .83		[1] .25	28	.01		.12
				30	.06		[1] .51
June 9	Trace.	Aug. 3	Trace.				
10	Trace.	30	Trace.		.69		
11	Trace.	31	.08		[1] .48		
13	.04						
			.08				
	.04		[1] .12				
	[1] .52						

---

[1] Normal.

SUMMARY.

The amounts of arsenic, lead, and copper remaining on mature fruits and vegetables which have been sprayed according to various schedules were determined in the Bureau of Chemistry. Table 15 gives the maximum and minimum results.

Because of overspraying or late spraying, comparatively large quantities of spray residues were found in some cases. This emphasizes the importance of spraying according to the schedules recommended by the Bureaus of Entomology and Plant Industry.

The extent of the reduction of spray residues on the mature fruit and vegetables by washing and wiping them was determined by a series of analyses before and after such treatment.

When peeled, sprayed fruits and vegetables contain essentially the same amounts of arsenic, lead, and copper as the unsprayed products, indicating that practically all of the spray residues can be removed by peeling.

From the results reported in this bulletin it is evident that when fruits and vegetables are sprayed in accordance with the schedules recommended by the Bureaus of Entomology and Plant Industry, but little of the material used remains on the fruit or vegetable at harvest time.

LITERATURE CITED.

(1) Academy of Medicine (France).
Proc. Acad. Med., Feb. 18, 1908. Bull. acad. med., 3 ser., **59** (1908): 246.

(2) ——— ———
Proc. Acad. Med., Feb. 2, 1909. Bull. acad. med., 3 ser., **61** (1909): 194.

(3) ——— ———
Sur un projet de décret portant modification de l'ordonnance de 1846 relative à la vente des substances vénéneuses. Bull. acad. med., 3 ser., **70** (1913): 152.

(4) ——— ———
Proc. Acad. Med., Nov. 11, 1913. Bull. acad. med., 3 ser., **70** (1913): 368, 369.

(5) ——— ———
Proc. Acad. Med., Mar. 3, 1914. Bull. acad. med., 3 ser., **71** (1914): 324, 325, 326.

(6) Alwood, W. B.
Treatment of diseases of the grape. Va. Agr. Exp. Sta. Bull. 15 (1892): 41.

(7) Ampola, G., and Tommasi, G.
I composti di arsenico in agricoltura. Ann. staz. chim. agrar. sper. Roma, 2 ser., **5** (1911): 241; J. Soc. Chem. Ind., **31** (1912): 891; Chem. Abst., **7** (1913): 1255; Exp. Sta. Rec., **30** (1914): 130.

(8) Andouard, A.
Le cuivre dans les vins provenant de vignes traitées par le sulfate de cuivre. Compt. rend., **104** (1887): 195; Bull. soc. nat. agr. (France), **47** (1887): 40; J. pharm. chim., 5 ser., **15** (1887): 290.

(9) ANONYMOUS.

Spraying fruits for insect pests and fungous diseases. U. S. Dept. Agr., Farmers' Bull. 7 (1892): 17–20.

(10) ———

Fruit spraying. J. Roy. Hort. Soc., **18** (1895): 185.

(11) BAKER, J. L.

A résumé of the report minutes of evidence and appendices of the Royal Commission on Arsenical Poisoning. J. Soc. Chem. Ind., **23** (1904): 168.

(12) BEACH, S. A.

Some celery diseases. N. Y. Agr. Exp. Sta. Bull. 51, n. ser. (1893): 146; Exp. Sta. Rec., **4** (1892–93): 926.

(13) BEDINI, R.

I sali arsenicali in frutticultura. L'istria agricola, 3 yr. (1910): 538.

(14) BERTIN-SANS, H., and ROS, V.

L'emploi de l'arsenic en agriculture ses dangers. Rev. hyg. pol. sanit., 29 yr. (1907): 193.

(15) ——— ———

À propos de l'utilisation des composés arsenicaux en agriculture. Rev. hyg. pol. sanit., 30 yr. (1908): 281; Exp. Sta. Rec., **20** (1908–09): 459.

(16) BOUFFARD, M.

La présence du cuivre métallique dans les vins provenant des vignes traitées au sulfate de cuivre. Bull. ministère agr. 8 (1887): 832.

(17) BRETEAU, P.

Sur la teneur en arsenic des vins provenant de vignes traitées par les composés de l'arsenic. J. pharm. chim., 6 ser., **28** (1908): 154; Chem. Abst., **2** (1908): 3257.

(18) BRIOUX and GRIFFON.

Les traitements arsenicaux en arboriculture fruitière. Bull. soc. nat. agr. (France), **70** (1910): 864.

(19) CARLES, P.

À propos du cuivre dans les tomates. Répert. pharm., 3 ser., **28** (1917): 193; Rev. sci., 55 yr. (1917): 183; Chem. Abst., **12** (1918): 192; Exp. Sta. Rec., **37** (1917): 263.

(20) ——— and BARTHE, L.

Recherche de l'arsenic de plomb dans des vins, des lies et des pépins provenant de vignes traitées à l'arséniate de plomb. Bull. soc. chim., 4 ser., **11** (1912): 413; Chem. Abst., **6** (1912): 1805; Exp. Sta. Rec., **27** (1912): 243.

(21) CAZENEUVE, P.

Sur les dangers de l'emploi des insecticides à base arsenicale en agriculture au point de vue de l'hygiène publique. Bull acad. med., 3 ser., **59** (1908): 133, 234.

(22) ——— ———

Proc. Acad. Med., Nov. 18, 1913. Bull. acad. med., 3 ser., **70** (1913): 415.

(23) CHUARD, E.

Observations concernant le mécanisme de l'introduction et de l'élimination du cuivre dans les vins provenant de vignes traitées par les combinaisons cuivriques. Compt. rend., **105** (1887): 1196.

(24) ——— ———

Présence et l'élimination de l'arsenic des vins. Trav. chim. alim. hyg. bur. sanit. fed., **1**, (1910): 82.

(25) Comboni, E.
Chemische Untersuchungen über die Weine aus Trauben, die mit kupferhaltigen Schutzmitteln gegen die Peronospora behandelt worden waren. Nuova Rassegna Vitic., **2**: 209; *through* Chem. Centr., 3 ser., 19 yr. (1888): 875.

(26) Cook, A. J.
Two new uses of important insecticides. Proc. 29 Meeting Am. Assoc. Adv. Sci. (1880) : 669.

(27) ——— ———
Experiments with insecticides. Proc. 2 Ann. Meeting Soc. Prom. Agr. Sci. (1881) : 112.

(28) Crolas and Raulin.
Traitement de la vigne par les sels de cuivre contre le mildew. Compt. rend., **103** (1886) : 1068; J. pharm. chim., 5 ser., **15** (1887) : 156.

(29) Cugini, G.
Ueber die Bekämpfung der Peronospora Viticula und den Einfluss der Mittel auf die Zusammensetzung des Mostes und Weines. Nat. Bot. Kongr. Parma, **1** (1887): 5, *through* Chem. Centr., 3 ser., 19 yr. (1888) : 532.

(30) Davis, G. C.
Celery insects. Mich. Agr. Exp. Sta. Bull. 102 (1893) : 44.

(31) Duclaux, E.
Sur le dosage de très petites quantités de cuivre et la présence de ce métal dans les cacaos et chocolats. Bull. soc. chim. **16** (1871) : 33.

(32) Duguet et al.
Proc. Acad. Med., June 28, 1910. Bull. acad. med., 3 ser., **63** (1910) : 657.

(33) ——— ———
Proc. Acad. Med., Mar. 7, 1911. Bull. acad. med., 3 ser., **65** (1911) : 346.

(34) ——— ———
Proc. Acad. Med., July 11, 1911. Bull. acad. med., 3 ser., **66** (1911) : 59.

(35) Dupré, A.
On copper in food. Analyst, **2** (1878) : 1.

(36) Fallot, B.
Le cuivre dans les vins. Prog. agr. vit., June 16, 1889; *through* U. S. Dept. Agr., Div. Bot. Bull. 11 (1890) : 96.

(37) Fetel, P.
De la teneur en arsenic des raisins d'Algérie et en particulier des raisins provenant des vignes ayant subi des traitements aux sels arsenicaux. Bull. agr. Algérie et Tunisie, **16** (1910) : 430; Exp. Sta. Rec., **25** (1911) : 40.

(38) Fletcher, J.
The results of an experiment to prove that apples are not poisoned by spraying with Paris green for codling moth. Can. Exp. Farms Rpt. for 1891, p. 189; Exp. Sta. Rec., **4** (1892–93) : 437.

(39) Forbes, S. A.
Spraying apples for the plum curculio. Ill. Agr. Exp. Sta. Bull. 108 (1906) : 279; Exp. Sta. Rec. **18** (1906–7) : 160.

(40) Forbush, E. H.
On the work of extermination of the gypsy moth. Mass. Bd. Agr. 41. Ann. Rpt. (1893): 282.

(41) Fréchou.
Le black-rot et les vins des vignes traitées. J. agr. (Barral), 24 yr. (1889): 649.

(42) Frühauf, T., and Ursic, G.
Die Bestimmung sehr geringer Mengen Kupfer. Bol. soc. Adriatica sc. nat. Trieste, **10**:103; *through* Chem. Centr., 3 ser., 19 yr. (1888):198; Staz. sper. agrar. ital. (1888):704; *through* J. Soc. Chem. Ind., **8** (1889):206.

(43) Galippe.
Sur la présence du cuivre dans les céréales, la farine, le pain et diverses autre substances alimentaires. Compt. rend. soc. biol., 7 ser., **4** (1882): 726; Rev. hyg. pol. sanit., 5 yr. (1883):23.

(44) ——— ———
Sur la présence du cuivre dans le cacao et dans le chocolat. J. pharm. chim., 5 ser., **7** (1883):505; Répert. pharm., n. ser., **11** (1883):267.

(45) ——— ———
Le sulfate de cuivre et le mildew. J. pharm. chim., 5 ser., **15** (1887):430.

(46) Galloway, B. T.
The grape scare in New York. U. S. Dept. Agr. Ann. Rpt. for 1891, p. 375.

(47) ——— ——— and Fairchild, D. G.
Copper on the fruit at the time of harvest. U. S. Dept. Agr., Div. Veg. Path. Jour. Mycol., **6** (1891):94.

(48) Garino, E.
Determination of arsenic in wine made from grapes that had been subjected to cuproarsenical treatment. Ann. accad. agr. Torino, **56** (1914): 78; Ann. chim. applicata, **3**:148; *through* Chem. Abst., **9** (1915):1526.

(49) Garman, H.
Spraying for codling moth. Ky. Agr. Exp. Sta. Bull. 53 (1894):125.

(50) ——— ———
The use of arsenites on tobacco. Ky. Agr. Exp. Sta. Bull. 53 (1894):142.

(51) ——— ———
Insects injurious to cabbage. Ky. Agr. Exp. Sta. Bull. 114 (1904).

(52) Gautier, A.
Sur l'emploi des arsenicaux en agriculture. Bull. acad. med., 3 ser., **59** (1908):229.

(53) ——— ———
Proc. Acad. Med., Nov. 11, 1913. Bull. acad. med., 3 ser., **70** (1913):370.

(54) ——— ———
Proc. Acad. Med., Mar. 3, 1914. Bull. acad. med., 3 ser., **71** (1914):300.

(55) ——— ——— and Clausmann, P.
Origines alimentaires de l'arsenic normal chez l'homme. Compt. rend., **139** (1904):101; Exp. Sta. Rec., **16** (1904–05):489.

(56) Gayon, U., and Millardet, A.
Le cuivre dans la récolte des vignes soumises à divers procédés de traitement du mildew par les composés cuivreux. Compt. rend., **103** (1886): 1240; J. pharm. chim., 5 ser., **15** (1887):153.

(57) Gibbs, H. D., and James, C. C.
On the occurrence of arsenic in wine. J. Am. Chem. Soc., **27** (1905):1484.

(58) Gillette, C. P.
Experiments with arsenites. Iowa Agr. Exp. Sta. Bull. 10 (1890):410.

(59) ——— ———
Notes and experiments upon injurious insects and insecticides. Iowa Agr. Exp. Sta. Bull. 12 (1891):536.

(60) Günther, A.
Ergebnisse der amtlichen Weinstatistik, Berichtsjahr 1908-1909. Arb. Kais. Gesundh., **35** (1910):1; Exp. Sta. Rec., **24** (1911):267.

(61) HEIDE, C. VON DER.
Analytische Befunde von Mosten und Weinen aus Trauben der mit Bleiarseniat bespritzten Reben. Ber. Kgl. Lehranst. Wein-, Obst- u. Gartenbau, Geisenheim (1906): 228; Chem. Abst., **3** (1909) : 2338.

(62) HOFFMANN, M.
Ein Beitrag zur Translokation des Kupfers beim Keltern gekupferter Trauben. Centr. Bakt. Parasitenk, part 2, **4** (1898) : 369, 422.

(63) HOWARD, L. O.
Progress in economic entomology. U. S. Dept. Agr. 1899 Yearbook, p. 146.

(64) KEDZIE, R. C.
Influence of Paris green on the potato. Michigan Farmer, June 6, 1872.

(65) ——— ———
The use of poisons in agriculture. Mich. Bd. Health, 3 Ann. Rpt. (1875):11.

(66) ——— ———
Mineral residues in sprayed fruits. Mich. Agr. Exp. Sta. Bull. 101 (1893): 19; Exp. Sta. Rec., **5** (1893–94) : 793.

(67) KILGORE, B. W.
On the cause and prevention of the injury to foliage by arsenites, together with a new and cheap arsenite, and experiments on combining arsenites with some fungicides. N. C. Agr. Exp. Sta. Bull. 77–b (1891) : 7.

(68) KINNEY, L. F.
Leaf blight of the pear. R. I. Agr. Exp. Sta. Bull. 27 (1894); Exp. Sta. Rec., **5** (1893–94) : 986.

(69) KRÜGER, F.
Ueber den Einfluss von Kupfervitriol auf die Vergärung von Traubenmost durch Saccharomyces ellipsoideus. Centr. Bakt. Parasitenk, part 2, **1** (1895): 64.

(70) LE BARON, W.
Second annual report on the noxious insects of the State of Illinois (1872), p. 116.

(71) LEHMANN, K. B.
Hygienische Studien über Kupfer. Arch. Hyg., **24** (1895) : 18.

(72) ——— ———
Hygienische Studien über Kupfer. Arch. Hyg., **27** (1896): 1; Analyst, **21** (1896): 290.

(73) ——— ———
Hygienische Studien über Kupfer. Arch. Hyg., **30** (1897): 250.

(74) LIBERI, G., CUSMANO, A., MARSIGLIA, T., and ZAY, C.
The presence of copper in tomatoes and tomato preserves. Ann. staz. chim. agrar. sper. Roma, ser. 2, **8** (1916): 163; *through* Bull. Agr. Intelligence, 7 yr. (1916): 662, and Chem. Abst., **11** (1917): 1701.

(75) LODEMAN, E. G.
The spraying of plants (1896), p. 64, 65. MacMillan & Co., New York.

(76) LUCET, A.
Proc. Acad. Med., Mar. 3, 1914. Bull. acad. med., 3 ser., **71** (1914): 299, 311.

(77) MCELROY, K. P.
Canned vegetables. U. S. Dept. Agr., Div. Chem. Bull. 13, part 8 (1893).

(78) MCMURTRIE, W.
The influence of arsenical compounds, when present in the soil, upon vegetation. U. S. Com. Agr. Rpt. for 1875, p. 147.

(79) Mach, E.
Bericht über die Ergebnisse der im Jahre 1886 ausgeführten Versuche zur Bekämpfung der Perenospora. Tirol. Landw. Bl., **6** (1887): 37, 53; *through* Jahr. Agr. Chem. (Hilger), n. ser., **10** (1887): 270.

(80) Malvy, M.
J. agr. prat., **22** (1911) : 293.

(81) —— ——
Décret concernant l'importation, le commerce, la détention et l'usage des substances vénéneuses. Bull. intern. repr. fraudes, 9 yr. (1916) : 145.

(82) Marès, R.
Les bouillies arsenicales et la lutte contre les altises. Rev. vit., **25** (1906): 426.

(83) Mathieu, M.
Recherche de l'arsenic sur les raisins et dans les vins. Ann. fals., 5 yr. (1912): 78; Chem. Abst., **7** (1913): 204; Exp. Sta. Rec., **26** (1912): 841; J. Soc. Chem. Ind., **31** (1912): 295.

(84) Maynard, S. T.
The amount of copper on sprayed fruit. Mass. Hatch Agr. Exp. Sta. Bull. 17 (1892): 38; Exp. Sta. Rec., **3** (1891–92): 865.

(85) —— ——
The amount of copper on sprayed fruit. Mass. Hatch Agr. Exp. Sta. Bull. 17 (1892): 39; Exp. Sta. Rec., **3** (1891–92): 865.

(86) Méline, J.
Instruction pour la vente et l'emploi en agriculture des composés arsenicaux. Bull. intern. repr. fraudes, 9 yr. (1916): 157.

(87) Mestrezat, W.
La question du danger de l'emploi des sels arsenicaux en agriculture. J. pharm. chim., 6 ser., **28** (1908): 393; Chem. Abst., **3** (1909): 1569; Exp. Sta. Rec., **20** (1908–09): 959.

(88) Millardet, A.
Ann. soc. agric. Cironde, Apr. 1, 1885, p. 73; *through* The Spraying o Plants, by E. G. Lodeman, p. 27.

(89) —— ——
Sur l'histoire du traitement du mildiou par le sulfate de cuivre. J. agr. prat., **2** (1885): 801.

(90) —— —— and Gayon, U.
Recherche du cuivre sur les vignes traitées par le mélange de chaux et de sulfate de cuivre, et dans la récolte. Compt. rend., **101** (1885) : 985; J. agr. prat., **2** (1885): 732.

(91) Mirman, M.
Proc. Acad. Med., Feb. 2, 1909. Bull. acad. med., 3 ser., **61** (1909): 194.

(92) Moreau, L., and Vinet, E.
L'arseniate de plomb en viticulture. Compt. rend., **150** (1910) : 787; Bull. agr. Algérie et Tunisie,. **6** (1910) : 187; Exp. Sta. Rec., **24** (1911): 168; Ann. chim. anal., **15** (1910): 346; Chem. Abst., **4** (1910): 2539.

(93) —— ——
Sur les traitements insecticides en viticulture. Compt. rend., **151** (1910): 1068; Exp. Sta. Rec., **25** (1911): 40.

(94) —— ——
L'arseniate de plomb en viticulture et la consommation des raisins frais et des raisins sec. Compt. rend., **151** (1910): 1147; Ann. chim. anal., **16** (1911): 94; Chem. Abst., **5** (1911): 1968; Exp. Sta. Rec., **25** (1911): 40.

(95) Moreau, L., and Vinet, E.
Comment s'élimine l'arseniate de plomb apporté par la vendange. Compt. rend., **152** (1911): 1057; Chem. Abst., **5** (1911): 2296.

(96) Moureu et al.
Sur l'emploi des composés arsenicaux en agriculture considéré au point de vue de l'hygiène publique. Bull. acad. med., 3 ser., **61** (1909): 17; L'engrais, **24** (1909): 211; Chem. Abst., **3** (1909): 1569.

(97) Munson, W. M.
Report of the horticulturist. Maine Agr. Exp. Sta. Ann. Rpt. for 1891, p. 106.

(98) Muttelet, C. F.
L'arseniate de plomb en viticulture. Ann. fals., 9 yr. (1916): 298; Chem. Abst., **11** (1917): 684; Exp. Sta. Rec., **36** (1917): 537.

(99) Muttelet, F., and Touplain, F.
L'arseniate de plomb en viticulture. Ann. fals., 5 yr. (1912): 9; Chem. Abst., **6** (1912): 910.

(100) Odling, W., and Dupré, A.
On the existence of copper in organic tissues. Guy's Hospital Reports, 3 ser., **4** (1858): 103.

(101) O'Gara, P. J.
Presence of arsenic in fruit sprayed with arsenate of lead. Science, n. ser., **33** (1911): 900; Chem. Abst., **6** (1912): 898; Exp. Sta. Rec., **25** (1911): 642.

(102) O'Kane, W. C., Hadley, C. H., and Osgood, W. A.
Arsenical residues after spraying. N. H. Agr. Exp. Sta. Bull. 183 (1917); Exp. Sta. Rec., **38** (1918): 54; Chem. Abst., **11** (1917): 2836.

(103) Ormerod, Eleanor A.
Notes of the season. U. S. Dept. Agr., Div. Ent. Per. Bull., Insect Life, **4** (1891–92): 36.

(104) Papasogli, G.
Anwendung der Kupfersalze auf die Weinstöcke und hierauf bezugliche Betrachtungen. L'Orosi, **10** (1887): 369; *through* Chem. Centr., 3 ser., 19 yr. (1888): 234.

(105) Penny, C. L.
Several articles of food known to be healthful found to contain small quantities of copper. Del. Agr. Exp. Sta. 2 Ann. Rpt. (1889): 172; Exp. Sta. Rec., **2** (1890–91): 324.

(106) ——— ———
Copper on grapes. Del. Agr. Exp. Sta. 3 Ann. Rpt. (1890): 149; Exp. Sta. Rec., **3** (1891–92): 690.

(107) Perrett, M.
Le sulfate de cuivre contre le phylloxera et le mildiou. J. agr. prat., **2** (1885): 630.

(108) Polacci, E.
Ueber eine chemische Thatsache, welche beweist, dass Schwefelsaures Kupfer aus den Trauben nur in ganz geringen Mengen in den Wein übergehen kann, nebst kritischen Bemerkungen über einige zur Bekämpfung der Perenospera vorgeschlagene Mittel. Rendi. ist. Lombardo, **20**: 413; *through* Chem. Centr., 3 ser., 18 yr. (1887): 939.

(109) Popenoe, E. A., and Mason, S. C.
Second report on the experimental vineyard. Kan. Agr. Exp. Sta. Bull. 28 (1891): 166; Exp. Sta. Rec., **3** (1891–92): 788.

(110) PORCHET, F.
Les traitements culturaux aux sels d'arsenic et l'hygiène alimentaire. Trav. chim. alim. hyg. bur. sanit. féd., **1** (1910): 79; Schweiz. Wochschr., 48 yr. (1910): 694; Chem. Abst., **5** (1911): 754.

(111) QUANTIN, H.
Sur la réduction du sulfate de cuivre pendant la fermentation du vin. Compt. rend., **103** (1886): 888; J. pharm. chim., 5 ser., **15** (1887): 39.

(112) RICHE, A.
Sur les dangers de l'emploi des insecticides à base arsenicale en agriculture. Bull. acad. med., 3 ser., **59** (1908): 192, 244.

(113) RILEY, C. V.
Potato pests, p. 67. Orange Judd Co., New York (1876).

(114) RISING, W. B.
Report of the State Analyst for 1887. Ann. Rpt. Bd. Calif. State Vit. Com. for 1887, p. 133.

(115) ROYAL COMMISSION ON ARSENICAL POISONING.
Final Report, p. 36. Eyre and Spottiswoode, London (1903).

(116) SCRIBNER, F. LAMSON.
Fungous diseases of plants. Rpt. U. S. Com. Agr. for 1885, p. 84.

(117) SELBY, A. D.
The relation of grape spraying to public health. Ohio Agr. Exp. Sta. Bull. 130 (1902): 42; Exp. Sta. Rec., **14** (1902–03): 61.

(118) SESTINI, F., and TOBLER, O.
Ueber das Kupfer welches Weine enthalten, die aus mit Kupfersalzen behandelten Trauben herstammen. L'Orosi, **10** (1887): 289; *through* Chem. Centr., 3 ser., 18 yr. (1887): 1450.

(119) SONNTAG, G.
Zu der Verwendung von Arsen und Blei enthaltenden Pflanzenschutzmitteln. Arb. Kais. Gesundh., **49** (1914): 502; Chem. Centr., 86 yr. (1915): 450; Chem. Abst., **9** (1915): 1819.

(120) SPALLINO, R.
Sulla presenza del bario e dell' arsenico nei tabacchi lavorati italiani. Gazz. chim. ital., 43 yr., part 2 (1913): 475; Chem. Abst., **8** (1914): 787; Exp. Sta. Rec., **31** (1914): 715.

(121) SZAMEITAT, A.
Analytische Befunde von Mosten und Weinen aus Trauben der mit Arsenverbindungen bespritzten Reben. Ber. Kgl. Lehranst. Wein-, Obst- u. Gartenbau Geisenheim (1907), p. 176; Exp. Sta. Rec., **20** (1908–09): 1163; Chem. Abst., **3** (1909): 685.

(122) ——————
Vorkommen des Arsens in deutschen Weinen. Ber. Kgl. Lehranst. Wein-, Obst- u. Gartenbau Geisenheim (1907), p. 180; Exp. Sta. Rec., **20** (1908–09): 1163; Chem. Abst., **3** (1909): 685.

(123) TEYXEIRA, G.
Ueber die Behandlung des Liebesapfels (der Tomate) mit Kupferverbindungen. Giorn. farm. Trieste, **2** (1897): 71; *through* Vierteljahr. Chem. Nahr. Genussmtl., 12 yr. (1897): 286, and Exp. Sta. Rec., **9** (1897–98): 569.

(124) TROFIMENKO, M., and OBIEDOFF, S.
Le vin des raisins traités aux arseniates. Prog. agr. vit., **65** (1916): 331; Bull. Agr. Intelligence, 7 yr. (1916): 1023; Chem. Abst., **11** (1917): 2383.

(125) TRUELLE, A.
L'emploi des composés arsenicaux en arboriculture aux États-Unis. Bull. soc. nat. agr., **69** (1909): 99.

(126) ——— ———
L'emploi des insecticides arsenicaux en Angleterre. J. agr. prat., n. ser., **17** (1909): 268.

(127) TSCHIRCH, A.
Das Kupfer, p. 133. Ferdinand Enke, Stuttgart (1893).

(128) VAN SLYKE, L. L.
Analyses of sprayed grapes. N. Y. Agr. Exp. Sta. Bull. 41 (1892): 56; Exp. Sta. Rec., **4** (1892–93): 55.

(129) WEED, C. M.
The combination of insecticides and fungicides. Ohio Agr. Exp. Sta. Bull., Vol. 2, No. 7, 2 ser., No. 14, (1889): 186; Agr. Science, **3** (1889): 263.

(130) WEISS, M.
Sur l'emploi des composés arsenicaux en agriculture, considéré au point de vue de l'hygiène publique. Bull. acad. med., 3 ser., **61**, (1909): 140.

(131) WHEELER, H. J.
Grapes sprayed with Bordeaux. R. I. Agr. Exp. Sta. 4 Ann. Rpt. (1892): 84; Exp. Sta. Rec., **4** (1892–93): 242.

(132) WHEELER, J. H.
Some pests and diseases of the vine, with remedies. Rpt. 6 Ann. Calif. State Vit. Conven. (1888): 63.

(133) WOODS, C. D.
Analyses for poison of apples sprayed with arsenate of lead in mid-summer. Maine Agr. Exp. Sta. Bull. 224 (1914): 46; Exp. Sta. Rec., **31** (1914): 141; Chem. Abst., **9** (1915): 503.

(134) ZECCHINI and RAVIZZA.
Copper in wine. Staz. sper. agrar. ital. **16** (1889): 73; *through* J. Soc. Chem. Ind., **8** (1889): 910.

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
10 CENTS PER COPY
▽